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CARMONETTE. VOLUME III. TECHNICAL DOCUMENTATION

Richard G. Williams

General Research Corporation

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A programmer's manual that describes, in detail, the model logic, data handling, and operation. It contains descriptions of labeled commons, subroutines, and has flow charts for the majority of subroutines. A running guide for both Control Data and UNIVAC versions of model.

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INTRODUCTION

This volume of the CARMONETTE documentation is written for the programmer/analyst who must maintain and modify the model logic. It assumes a thorough understanding of the material contained in Volumes I and II.

Part I of this volume describes the Preprocessor logic, Part II describes the Battle Model logic, and Part III describes the Post Processor.

The descriptions of the model routines are written relative to the CDC 6400 version of CARMONETTE. In general they also apply to the UNIVAC 1108 version. However, changes were made to the model structure when it was converted to the UNIVAC 1108.

1. The two preprocessors were restructured into one preprocessor (eliminating the need for the intermediate file TAPE 3) and a separate Terrain Generator. See Appendix B, UNIVAC 1108 Running Guide.

2. The concept of father-son treatments was eliminated. Variations of a basic treatment are created by use of the UNIVAC EXEC8 processors (ELT, ED) on the user's data files and the updating function of the preprocessors has been eliminated. A run on the UNIVAC 1108 will consist of just one treatment and all logic pertaining to multiple treatments has been deleted.

3. Because CARMONETTE was converted from the CDC 6400 (60-bit word) to the UNIVAC 1108 (36-bit word) allowances had to be made for the storage of data. In general, two consecutive 36-bit words are used to store the data that was originally stored in one 60-bit word. See Appendixes C and D for descriptions of data packing.

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Part I

THE PREPROCESSORS

The first preprocessor reads the input cards, checks the input for error in upper and lower bound, and prints a message if error exists. The input is scaled, if necessary, and packed into the appropriate array in labeled common MAIN, if further computation is not required. If further computation is required it is entered in an array in labeled common INTER for temporary storage. Tape 3, input to the second preprocessor, or back to the first preprocessor in case of an input update, is written.

Overlay (2,0) prints out the input, mostly in tabular form.

Overlay (3,0) is the Terrain Generator. It reads and checks the terrain input, punches the land deck (6 squares, 72 columns per card), and prints the input, including errors if any, and the contents of the land deck.

Flow charts and documentation of the initialization of DTREAD and the processing of certain input forms are included in this section.

The second preprocessor sets available weapons clocks to INFL and unavailable to INFU. The bits for type of unit are set in JATRIB for each unit. Initial line of sight, cover, and concealment for each unit are set. The first order for each unit is entered in its JCNTRL array. If the output option is selected the weapons, with their crew, ammunition, ranges, and target priorities are printed. The hit probabilities for maximum, minimum, and three intermediate ranges, for each weapon and ammunition type, target size, target activity, and neutralization state of firer are computed and printed. Line of sight, concealment and cover are printed.

The flow charts and documentation which follow cover only those portions of the preprocessors which are considered complex. The program code should be consulted for those input forms not discussed.

Labeled Common INTER

This labeled common is used for two purposes. It is temporary storage for input before further processing by PACKER, FORM1, FORM3, or FORM23. It is the first record written on TAPE 3 by the first preprocessor and is used by the first preprocessor as input on TAPE 2, for updating TAPE 3. It is not used by the second preprocessor, being read and written over by MAIN common. For a description of MAIN common, see Appendix D.

The length of this common is stored in KONTRL(2) in BLOCK DATA STORE and equivalenced to NWINTR in DTREAD in the first preprocessor. The length is defined by data statement in BLOCK DATA DEFINE in the second preprocessor.

FSTR(6,6,4), BSTR(6,6,4), solid angle thresholds; six sensor types, six classes each type, four range thresholds each type (including max sensor range). FSTR, non-firing targets; BSTR firing targets. Input from form SENSOR 1.

IPR11(2,6,6),(2,2,6,6 on UNIVAC 1108); each side, sensor class, sensor type, detection probabilities, 1 to 1. IPRR12, 14, 21, 41, 44; input from forms SENSOR 2-10.

KWERR, KWERB; hold fire range, red and blue; input from form UNIT 2.

KSVRR1, KSVRR2; threshold range for danger state table; input from form UNIT 4.

JGM(56); the weapon type is a guided missile; input from Col 54, form WEAPON 1.

JWD(12); JLG(12); width and length of impact area for artillery weapons; input form WEAPON 1, Cols 43-46, 47-50.

FSIG(44); firing signature, non-artillery weapons (13-56); input form WEAPON 1, Cols 51-53, after weapon number 13.

JRV(56); by weapon type, round velocity in meters per second; input form WEAPON 1, Cols 38-42.

FKON(16,10); first index is cover state, second index is element size index for concealment conversion (divided by 10 π). Input form Terrain 2.

FLTG(77), FLTA(7); ordered movement rates, ground and air. Input form Mobility 6.

FMTA(5,3); air movement rates for steep descent, moderate descent, negligible slope, moderate climb, steep climb; for three mobility classes (5, 6, and 7). Input form Mobility 4.

FMTG(5,6,5); first index is ground mobility class. Second index is trafficability, first three for cross-country, second three for roads. The third index is the slope class threshold. Input form Mobility 2.

MINR(56), MAXR(56); minimum and maximum range for each weapon type. Input form Weapon 1.

FSLOP(5,6); ground slope thresholds for five mobility classes. Six slope thresholds are reserved, but only three are used. Input form Mobility 2.

MVL(6); not used.

KASQT(2); search area for TGTSEL. Input form Weapon 5.

FSTR1; first word address or intermediate common (Labeled common INTER)

The remainder of this common is used only for the special sensors, and has not been used since CARMONETTE IV.

FLDV(6); field of view for image intensifier device. Input ID, PNV1.

FOCAL(6); objective focal length for image intensifier. Input ID, PNV1.

DMAG(6); magnification for above.

DFNO(6); objective number for above.

DMSAF(6); maximum angular spatial frequency for above.

DMTF(11,6); 11 ordinates of system modular transfer FCN. Input ID, PNV1.

DLLDT(6); lower wave length limit of detection for image intensifier. Input ID, PNV1.

DULDT(6); upper wave length limit of detection for above.

MSURV(6); image intensifier device in surveillance mode or not.

MTACQ(6); device in target acquisition mode or not.

DXM(6); device transmission. Input ID, PNV1.

DPHSHS(11,6); ordinates of photocathode sensor. Input ID, PNV2.

BREF(11,16); background reflectance for 16 backgrounds. Input ID, PNV2.

TGTL(16); target length for 16 target classes. Input ID, BKV1.

TGTW(16); target width.

TGTH(16); target height.

TREF(11,16); wave length and target reflectance. Input ID, BKV1.

SB(11,3); sky brightness. Entered as data, Block Data BCURVE, equivalent to SB1.

JNK(6); photocathode type, Input ID, PNV1.

SIGS, SIGA; scattering and absorption coefficients indices. Used as indices for storing in JCOND array.

DMTC(6); modular transfer constant for six devices. Computed after statement 410 in Overlay (1,2), (NIGHTV).

SIGMA(6); resolution length. Computed in NIGHTV. (After statement 420.)

RDF(6); radar degradation factors. Used as index for storage in JCOND in NIGHTV.

KOND; light level for night vision device.

DIM(16); minimum target dimensions by target class.

JSS(22); initial input array for image intensifier data from form ID, PNV1.

RELUM(11): relative luminosity for night vision devices. Data statement in Block Data BCURVE.

LVA(31,2,3); visual angles for contrast. Block Data BCURVE. Equivalenced to array LVA1.

JVISAN(31,2); log of critical visual angle for given light level.

ALPHA(2); not used.

RNGRP(6); not used.

RNGRV(6); not used.

RVEL(6); not used.

IWORK; not used.

FS(22); image intensifier. Input from Form 37B, form ID PNV2.

Labeled common BCOM.

This labeled common contains the arrays for initial inputs before processing and storing into MAIN common. The dimension and equivalence statements which follow assign various arrays to begin storage location at JSVR(1).

The length of BCOM is stored in NWBCOM by data statement. This is used for initial clearing of all the arrays at the DO 310 loop of DTREAD.

The contents of the arrays, including those equivalenced, are listed below.

JSVR(36);Danger state input. Lead array of common BCOM. Input form Unit 4.

KVL(36); Ordered movement rates, second part of input form Mobility 6.

JEX(6); X-coordinate starting location. Input form Unit 10.
X-coordinate escape points. Input form Unit 7.

JWY(6); Same as JEX for Y-coordinate.

KSVRR(2);Not used.

LTG(7); Not used.

JAD(18); Its equivalence is used only in target priority list. Input form Weapon 5.

IDUMMY(12); Not used.

JKAM(22);Ammo selection. Input form Weapon 3.

JKPKH(22)Kill probability. Input Weapon 3.

JPROB(16)Probability of detection, firing target.Input form SENF

JSUB(14);Command unit subordinate units. Input form Unit 1.

IAR(9); Altitude change threshold..Input form Mobility 4.

JKBURN(12); Probability of indicating death. Input form Unit 8.

JCOV(18); Cover and concealment conversion and net cover. Input form Terrain 2.

JSLOP(12); Ground mobility slope thresholds, cross-country and road trafficability. Input form Mobility 2.

JVL(36); Ordered movement rates first part (ground) of input form Mobility 6. Out of ammo, input form Unit 6.

JMOV(4,4); Movement doctrine. Input form Mobility 1.

JOR(6); First order. Input form Unit 10.

KMOV(8,2); Used in processing input form Mobility 1.

JKPKH(22); Kill probability, given a hit. Input form Weapon 3.

KAA(18), KAB(8), KAC(8); Weapon accuracy, direct fire weapon (Hit Probabilities). Input form Weapon 2.

KAD(24); Equivalenced to KAA, KAB, and KAC, for packing into JTACSD.

JSUB(14); Subordinate units.

DTREAD

Initialization Section of DTREAD in the First Preprocessor

See Flow Charts, pages 10, 11, and 12.

If NSTART equals zero it is set equal to one. NSTART is initialized to zero by being equivalenced to KONTRL(7) which is set to zero by data statement in BLOCK DATA STORE. The first card is read and printed, and the KSWi are assigned. If KY is CARD, control goes to statement 70. The next card is read and printed. If it is INST(install) and father (treatment number ending in 01) control goes to statement 290 where the treatment number is stored in NTR. The BCOM common is cleared (DO 310). The next card is read and printed and routing is controlled by the identification (KY) of the card (statement 330). If KY equals ENDN or ENDP control goes to statement 360 where Overlay(1,1)(Subroutine PACKER) is called. If KY equals ENDP control is returned to DATCTL Overlay(0,0). ENDN and ENDP are loaded in BLOCK DATA FIX. ENDP indicates that output is to be printed, and the zero overlay (DATCTL) will call DTPRNT Overlay(2,0) which will do the editing and printing.

If KY does not equal ENDP (it is equal to ENDN) control goes to statement 130. After control returns to DATCTL Overlay(0,0) from DTPRNT Overlay(2,0), DTREAD Overlay(1,0) is called again. NSTART will equal one and control will go to 130.

At statement 130, the intermediate labeled common, INTER, and the labeled common MAIN are written on Tape 3. If the treatment is a father, both commons are written on Tape 1 (disc), followed by an end of file and the disc file rewound. Control then goes to statement 170 (KSW2) thru statement 160 (KSW1). The next card is read at statement 170 and if KY equals FINI control goes to statement 230 where the treatment number is set equal to 9999 (the flag), INTER and MAIN and EOF are written on Tape 3. Tape 3 is rewound and program goes to STOP at statement 260.

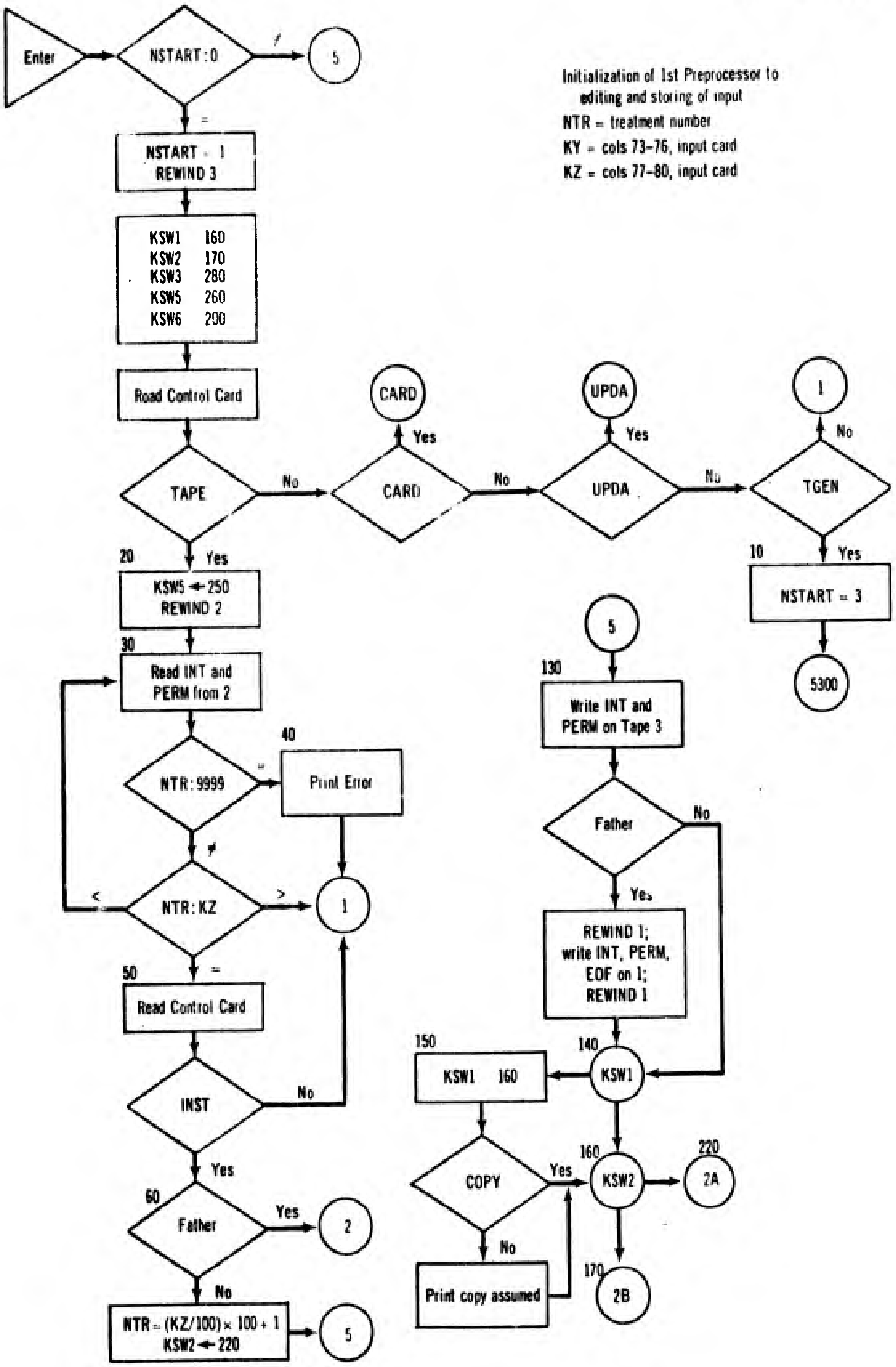
At statement 170, if KY equals INST, control goes to statement 210. If not a father, and the new treatment number is greater than NTR, indicating a son, control goes to statement 90, then to statement 280 where INTER and MAIN for the father are read from disc, and the new treatment number is stored in NTR. BCOM is cleared (DO 310), and control passes to statement 330, to process input cards as shown above.

At statement 210, if KY is a father, an error message is printed and control goes to 170. (More than one father cannot be on the same Tape 3.)

If the first card read is UPDA control goes to statement 80. KSW3, 5, 6 are assigned 100, 250, 190. Tape 2, the input tape is rewound and the next card read. If the treatment is a father and KY equals CHGE, control goes to statement 100. The first INTER and MAIN are read from Tape 2. If this is the treatment to be changed, control goes to statement 120, then to DO 310 to clear BCOM. Control then passes to statement 330.

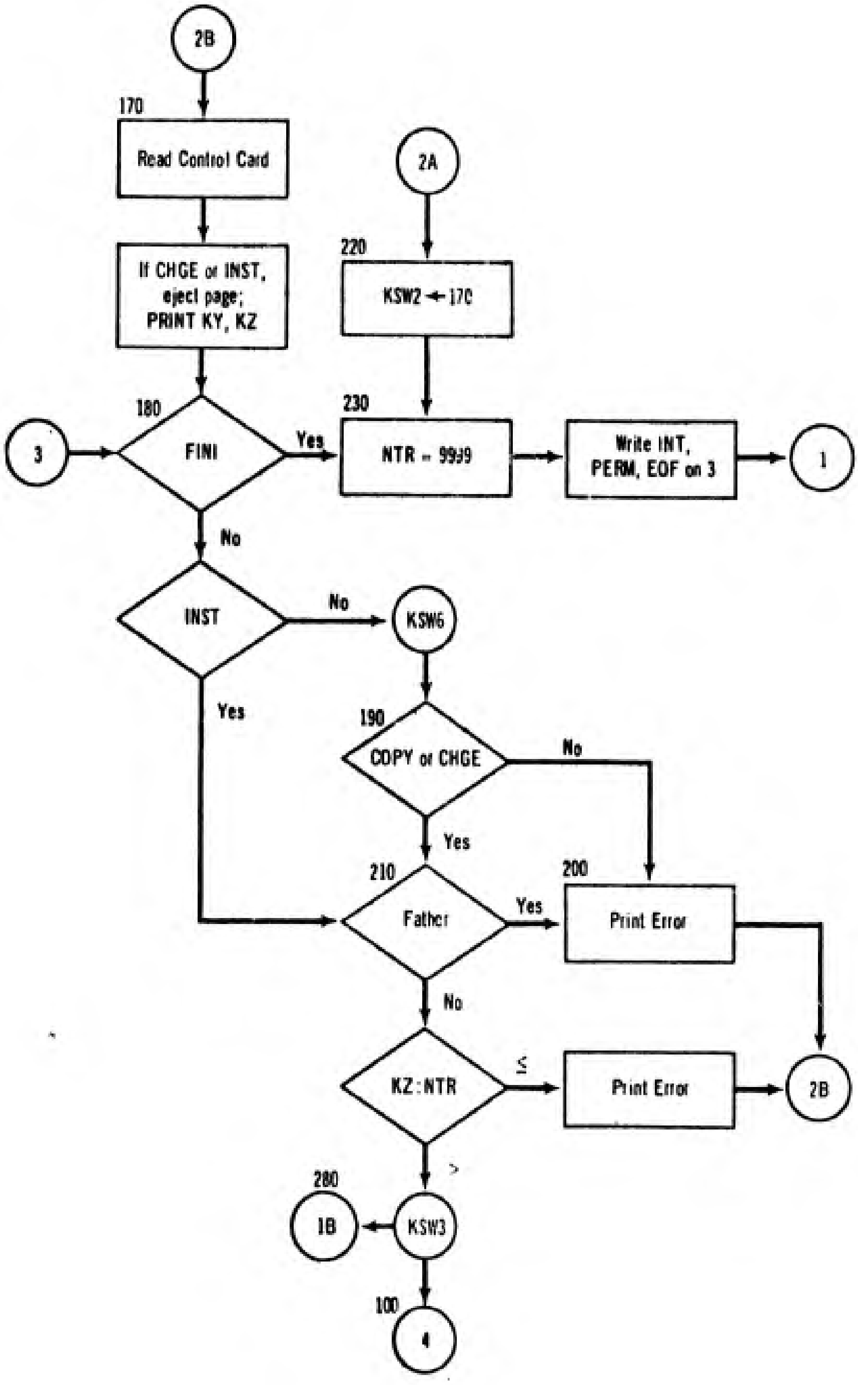
After statement 100, if the treatment to be changed has not been reached the process at 100 is repeated. Note that treatments on the tape must be in ascending order, although some treatment numbers may be omitted. All treatments must be updated even though no changes are made (use UPDAnnnn, ENDAnnnn cards, where nnnn is the treatment number). Any treatment not updated will be lost. The father must always be present. (As the program is now written the tape will not backspace to search for a son, but will hang up.) Thus all update cards for treatments must be in the same order as the treatments appear on the tape.

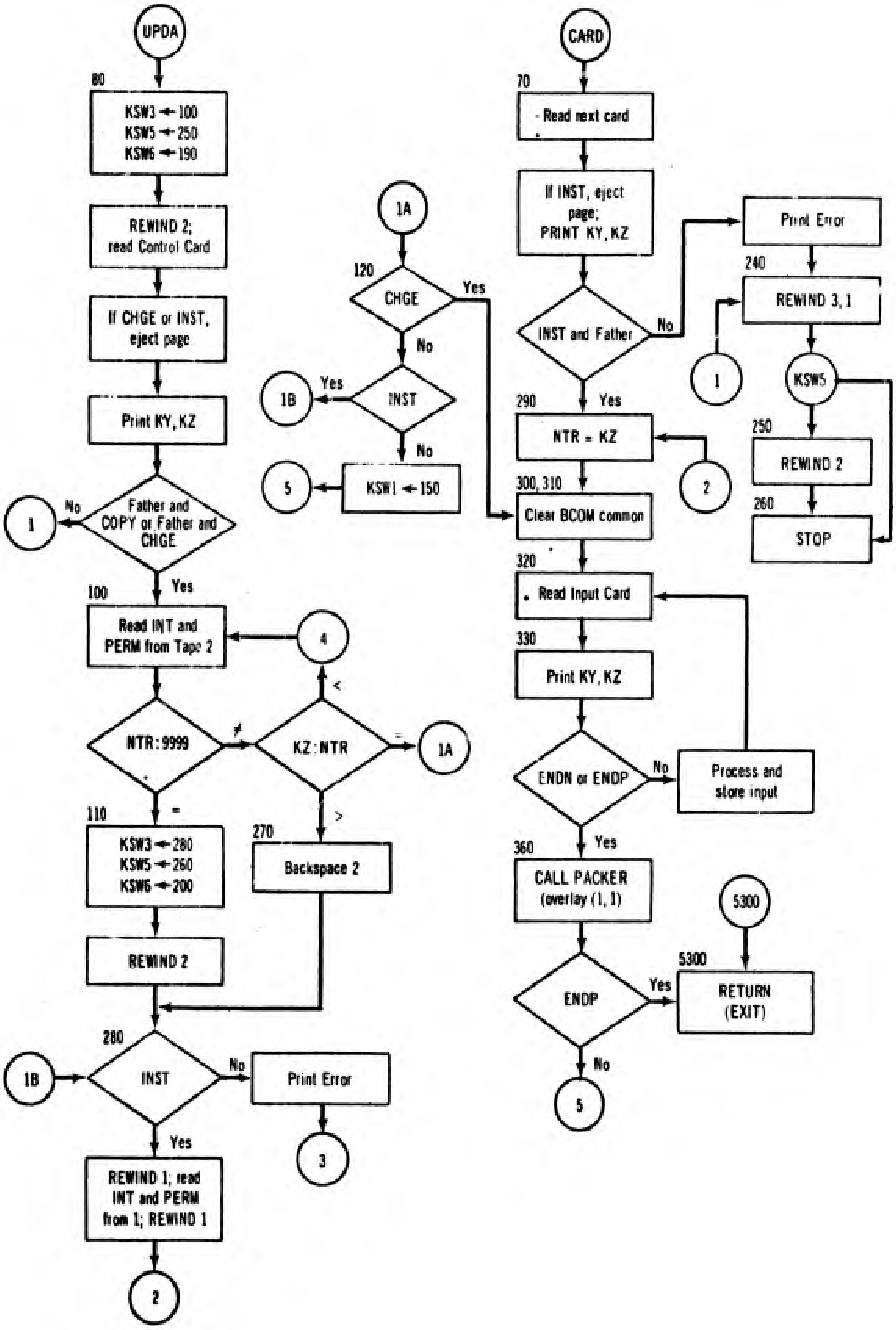
If the first card read is TAPE, control goes to statement 20. KSW5 is assigned 250. INTER and MAIN are read from the input tape. When the treatment to be processed is loaded, control goes to statement 50, and the next card is read. If KY equals INST, control goes to statement 60, if not an error message is printed and program stops. At statement 60 if the treatment is not a father it is given the father's number and control goes to statement 130. If it is a father, control goes to statement 290, BCOM is cleared (DO 310) and control passes to statement 330.



Initialization of 1st Preprocessor to editing and storing of input
NTR = treatment number
KY = cols 73-76, input card
KZ = cols 77-80, input card

Enter
NSTART : 0
≠
5
=
NSTART = 1
REWIND 3
KSW1 160
KSW2 170
KSW3 280
KSW5 260
KSW6 200
Read Control Card
TAPE
No
CARD
Yes
CARD
No
UPDA
Yes
UPDA
No
TGEN
No
1
20
Yes
KSW5 ← 250
REWIND 2
10
Yes
NSTART = 3
5300
30
Read INT and PERM from 2
40
NTR : 9999
=
Print Error
≠
<
NTR : KZ
>
1
=
50
Read Control Card
INST
No
Yes
60
Father
Yes
2
No
NTR = (KZ/100) × 100 + 1
KSW2 ← 220
5
5
130
Write INT and PERM on Tape 3
Father
No
Yes
REWIND 1;
write INT, PERM,
EOF on 1;
REWIND 1
150
KSW1 160
140
KSW1
COPY
Yes
No
Print copy assumed
160
KSW2
220
2A
170
2B


2B
170
Read Control Card
If CHGE or INST, eject page; PRINT KY, KZ
2A
220
KSW2 ← 170
180
3
FINI
Yes
230
NTR = 9999
Write INT, PERM, EOF on 3
1
No
INST
No
KSW6
Yes
190
COPY or CHGE
No
Yes
210
200
Father
Yes
Print Error
No
KZ:NTR
≤
Print Error
2B
>
280
1B
KSW3
100
4


UPDA
80
KSW3 ← 100
KSW5 ← 250
KSW6 ← 190
REWIND 2;
read Control Card
If CHGE or INST,
eject page
Print KY, KZ
Father and
COPY or Father and
CHGE
No
1
Yes
100
Read INT and
PERM from Tape 2
4
NTR: 9999
≠
KZ : NTR
<
=
1A
>
=
110
KSW3 ← 280
KSW5 ← 260
KSW6 ← 200
270
Backspace 2
REWIND 2
280
1B
INST
No
Print Error
3
Yes
REWIND 1; read
INT and PERM
from 1; REWIND 1
2
1A
120
CHGE
Yes
No
1B
Yes
INST
No
5
KSW1 ← 150
CARD
70
Read next card
If INST, eject
page;
PRINT KY, KZ
INST and Father
No
290
Yes
NTR = KZ
2
300, 310
Clear BCOM common
320
Read Input Card
330
Print KY, KZ
ENDN or ENDP
No
Process and
store input
360
Yes
CALL PACKER
(overlay (1, 1)
ENDP
Yes
5300
RETURN
(EXIT)
5300
No
5
Print Error
240
REWIND 3, 1
1
KSW5
250
REWIND 2
260
STOP

Input Form Terrain 2

See flow charts, pages 15, 16, and 17.

At DO 2320, the square root of the cover conversion is scaled 2^3 (input is in meters^2), and divided by π, and packed into JCNVRT.

At DO 2330, the square root of the concealment conversion (input in meters^2), is divided by 10π and stored in FKON array.

At DO 2360, the net cover index is checked and packed into JCNVRT.

FKON is further processed in subroutine PACKER starting after statement 400. FACT is computed equal to $\frac{7.9}{\text{FKON}(1,1)}$. FKON is indexed cover state, element size index. 7.9 represents the maximum packed 7.7 in octal At DO 640, KON is computed equal to FACT times each FKON, scaled 2^3, and packed into JCNVRT.

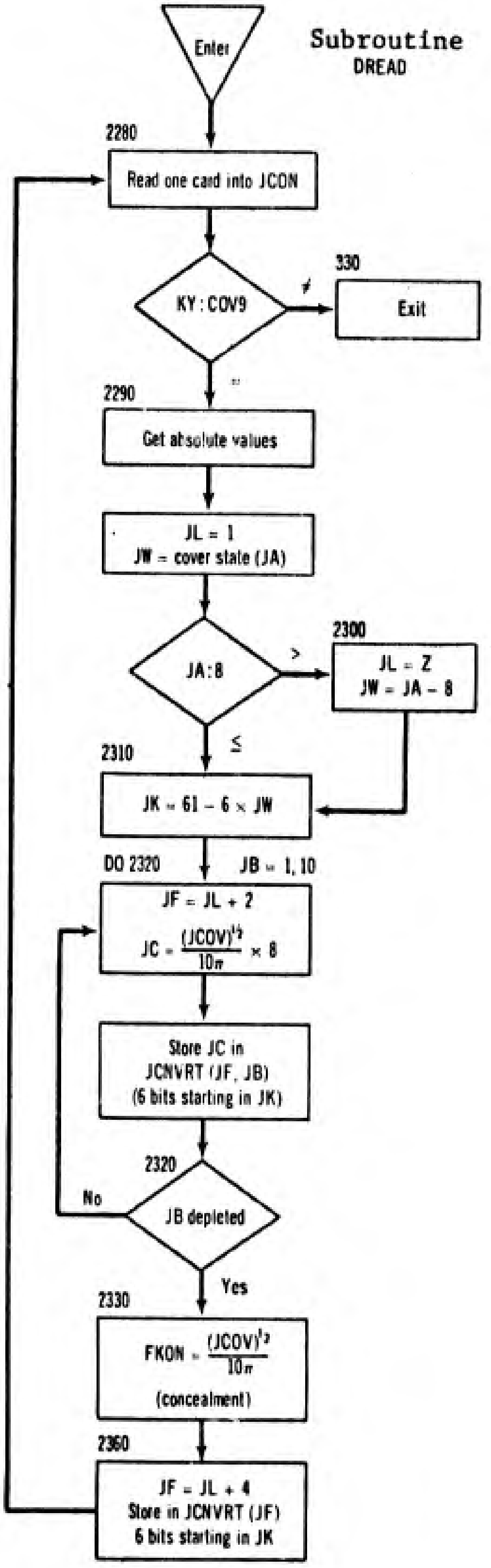
FACT as initially computed $(\frac{7.9}{\text{FKON}(1,1)})$ is passed on to the computation of non-firing solid angle thresholds, form Sensor 1 (SENS), in subroutine PACKER.

The steps of computation and scaling of concealment conversions and solid angle thresholds including the subroutines in which the steps occur are listed below.

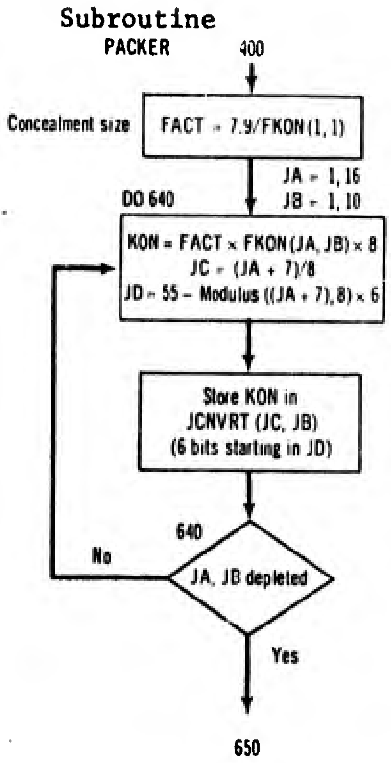
	Form	Subroutine
$\text{FKON} = \frac{(\text{Conc Conversion})^{1/2}}{10\pi}$	Terrain 2	DTREAD
$\text{FSTR} = \frac{\text{Solid angle non-firing}}{\pi}$	Sensor 1	DTREAD
$\text{BSTR} = \frac{\text{Solid angle firing}}{\pi}$	Sensor 1	DTREAD
$\text{FSIG} = \frac{(\text{Firing signature})^{1/2}}{10\pi}$	Weapon 1	FORM1
$\text{FACT} = \frac{7.9}{\text{FKON}(1,1)}$	where FKON(1,1) is the largest concealment conversion for cover state and element size. After statement 400 in PACKER	
$\text{FACT} = \text{FACT}^2 \times \text{GRID}^2 \times 2^{12}$	Sensor 1	PACKER

	Form	Subroutine
$JB = FSTR \times FACT$	Sensor 1	PACKER
JB is packed into JDTECT2 for solid angle thresholds and JDTECT32 for maximum solid angle		
$FM = \text{Max } FSIG$	Weapon 1	PACKER
$FACT = \frac{7.9}{FM}$	Weapon 1	PACKER
$FACT = FACT^2 \times GRID^2 \times 2^{12}$	Sensor 1	PACKER
$JB = BSTR \times FACT$	Sensor 1	PACKER
JB is packed into JDTECT29 for solid angle thresholds and JDTECT32 for maximum solid angle		

Input from
Terrain 2

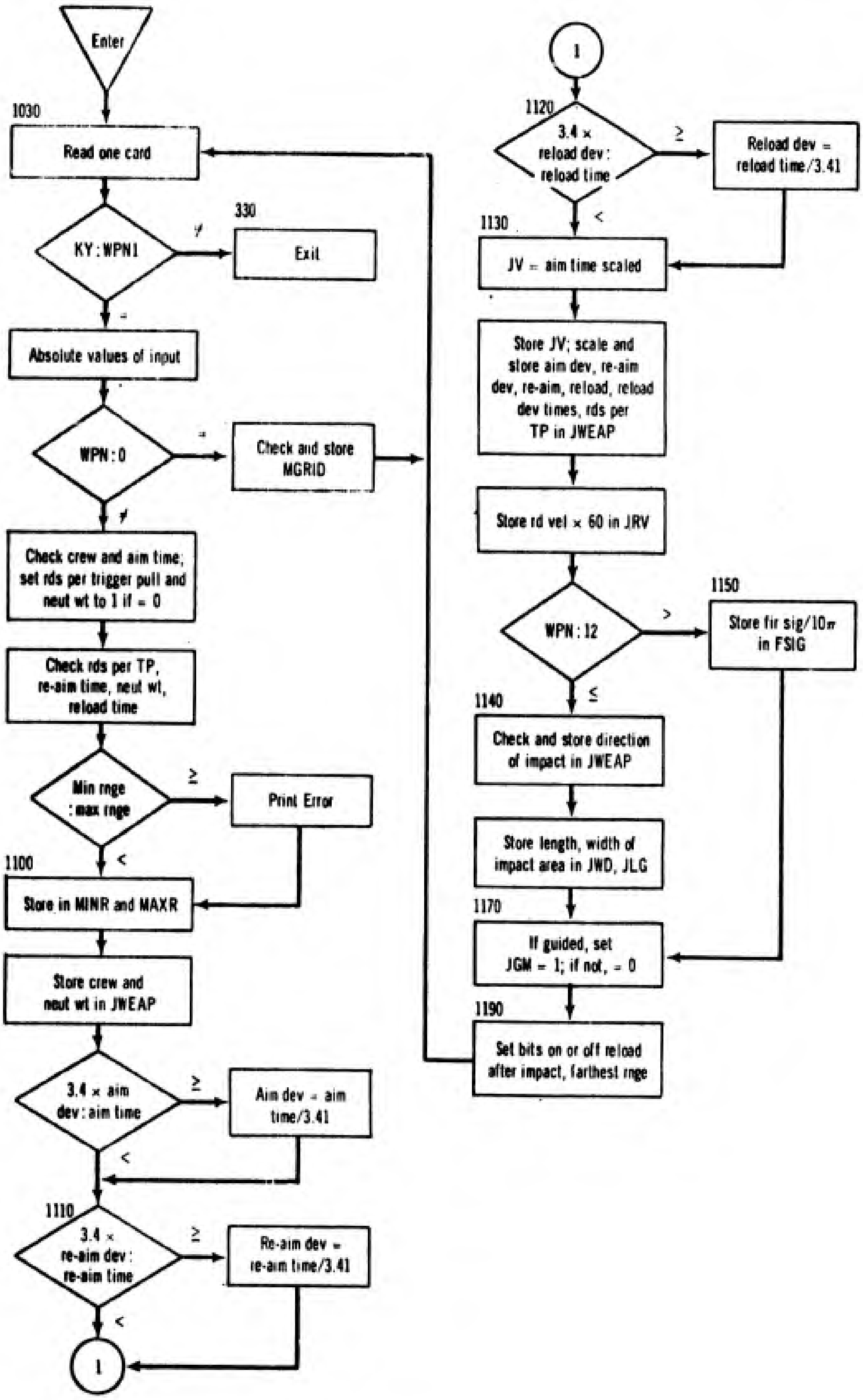


Subroutine
DREAD
Enter
2280
Read one card into JCON
KY : COV9
≠
330
Exit
=
2290
Get absolute values
JL = 1
JW = cover state (JA)
JA:8
>
2300
JL = Z
JW = JA − 8
≤
2310
JK = 61 − 6 × JW
DO 2320
JB = 1, 10
JF = JL + 2
JC = (JCOV)½ / 10π × 8
Store JC in
JCNVRT (JF, JB)
(6 bits starting in JK)
2320
No
JB depleted
Yes
2330
FKON = (JCOV)½ / 10π
(concealment)
2360
JF = JL + 4
Store in JCNVRT (JF)
6 bits starting in JK

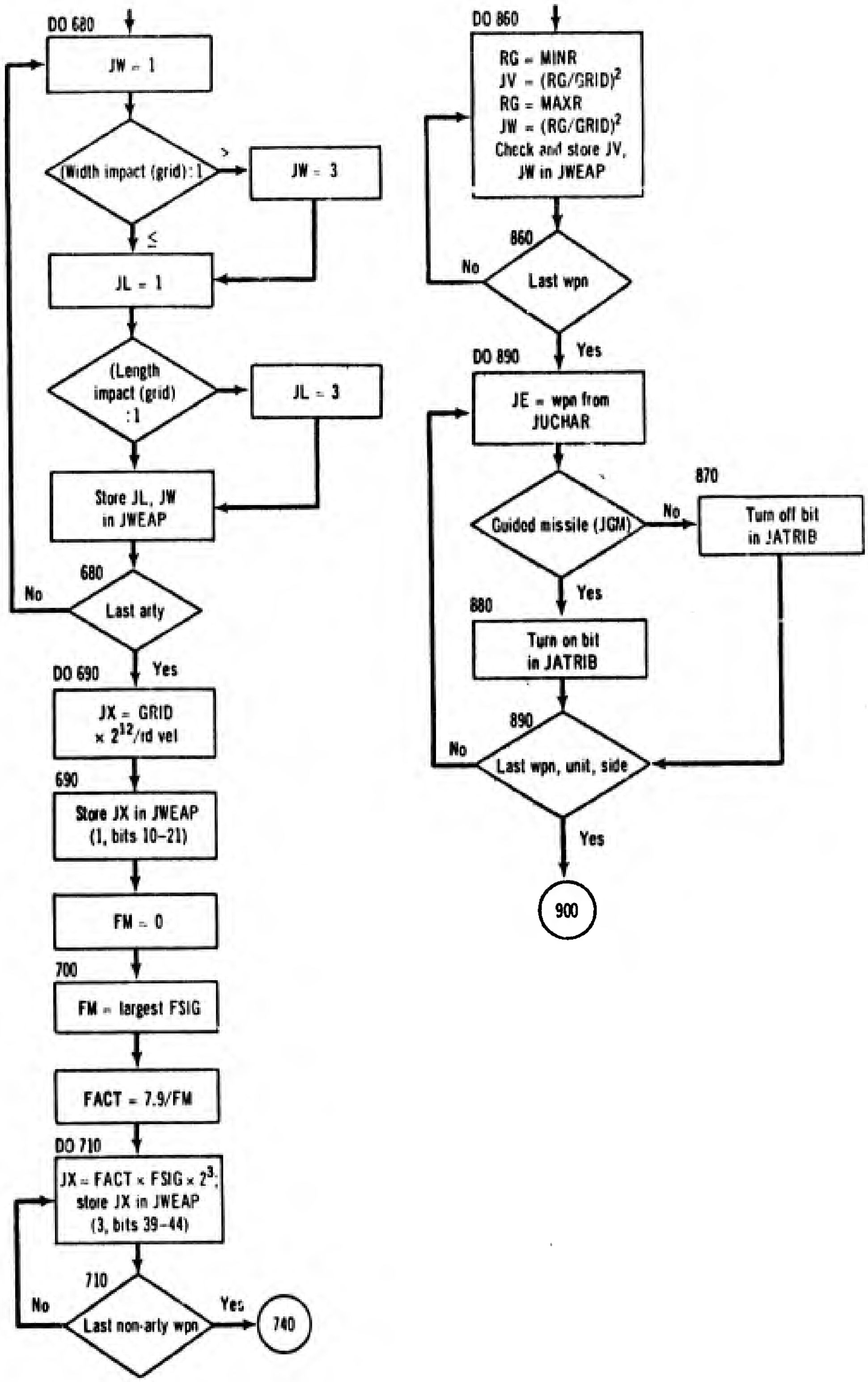


Subroutine
PACKER
400
Concealment size
FACT = 7.9/FKON (1, 1)
JA = 1, 16
JB = 1, 10
DO 640
KON = FACT × FKON (JA, JB) × 8
JC = (JA + 7)/8
JD = 55 − Modulus ((JA + 7), 8) × 6
Store KON in
JCNVRT (JC, JB)
(6 bits starting in JD)
640
No
JA, JB depleted
Yes
650

Subroutine DTREAD
Input form Weapon 1


Enter
1030
Read one card
KY : WPN1
≠
330
Exit
=
Absolute values of input
WPN : 0
=
Check and store MGRID
≠
Check crew and aim time; set rds per trigger pull and neut wt to 1 if = 0
Check rds per TP, re-aim time, neut wt, reload time
Min rnge : max rnge
≥
Print Error
<
1100
Store in MINR and MAXR
Store crew and neut wt in JWEAP
3.4 × aim dev : aim time
≥
Aim dev = aim time/3.41
<
1110
3.4 × re-aim dev : re-aim time
≥
Re-aim dev = re-aim time/3.41
<
1
1
1120
3.4 × reload dev : reload time
≥
Reload dev = reload time/3.41
<
1130
JV = aim time scaled
Store JV; scale and store aim dev, re-aim dev, re-aim, reload, reload dev times, rds per TP in JWEAP
Store rd vel × 60 in JRV
WPN : 12
>
1150
Store fir sig/10π in FSIG
≤
1140
Check and store direction of impact in JWEAP
Store length, width of impact area in JWD, JLG
1170
If guided, set JGM = 1; if not, = 0
1190
Set bits on or off reload after impact, farthest rnge

Subroutine PACKER
Input form Weapon 1



DO 680
JW = 1
(Width impact (grid) : 1
>
JW = 3
≤
JL = 1
(Length impact (grid) : 1
JL = 3
Store JL, JW in JWEAP
680
No
Last arty
Yes
DO 690
JX = GRID × 2^12/rd vel
690
Store JX in JWEAP (1, bits 10–21)
FM = 0
700
FM = largest FSIG
FACT = 7.9/FM
DO 710
JX = FACT × FSIG × 2^3; store JX in JWEAP (3, bits 39–44)
710
No
Last non-arty wpn
Yes
740
DO 860
RG = MINR
JV = (RG/GRID)^2
RG = MAXR
JW = (RG/GRID)^2
Check and store JV, JW in JWEAP
860
No
Last wpn
Yes
DO 890
JE = wpn from JUCHAR
870
Guided missile (JGM)
No
Turn off bit in JATRIB
Yes
880
Turn on bit in JATRIB
890
No
Last wpn, unit, side
Yes
900

Input Form Weapon 3, Subroutine DTREAD

If the preferred ammo is type 1, J6 is assigned 2140, if type 2, J6 is assigned 2150.

JG, the second index for JPKILL, is computed, JG = (JA+5)/6, where JA is the vulnerability class. JK, the initial bit position for storage is JPKILL, is computed by JW = MOD(JA+5,6) × 6 and JK = 55-JW.

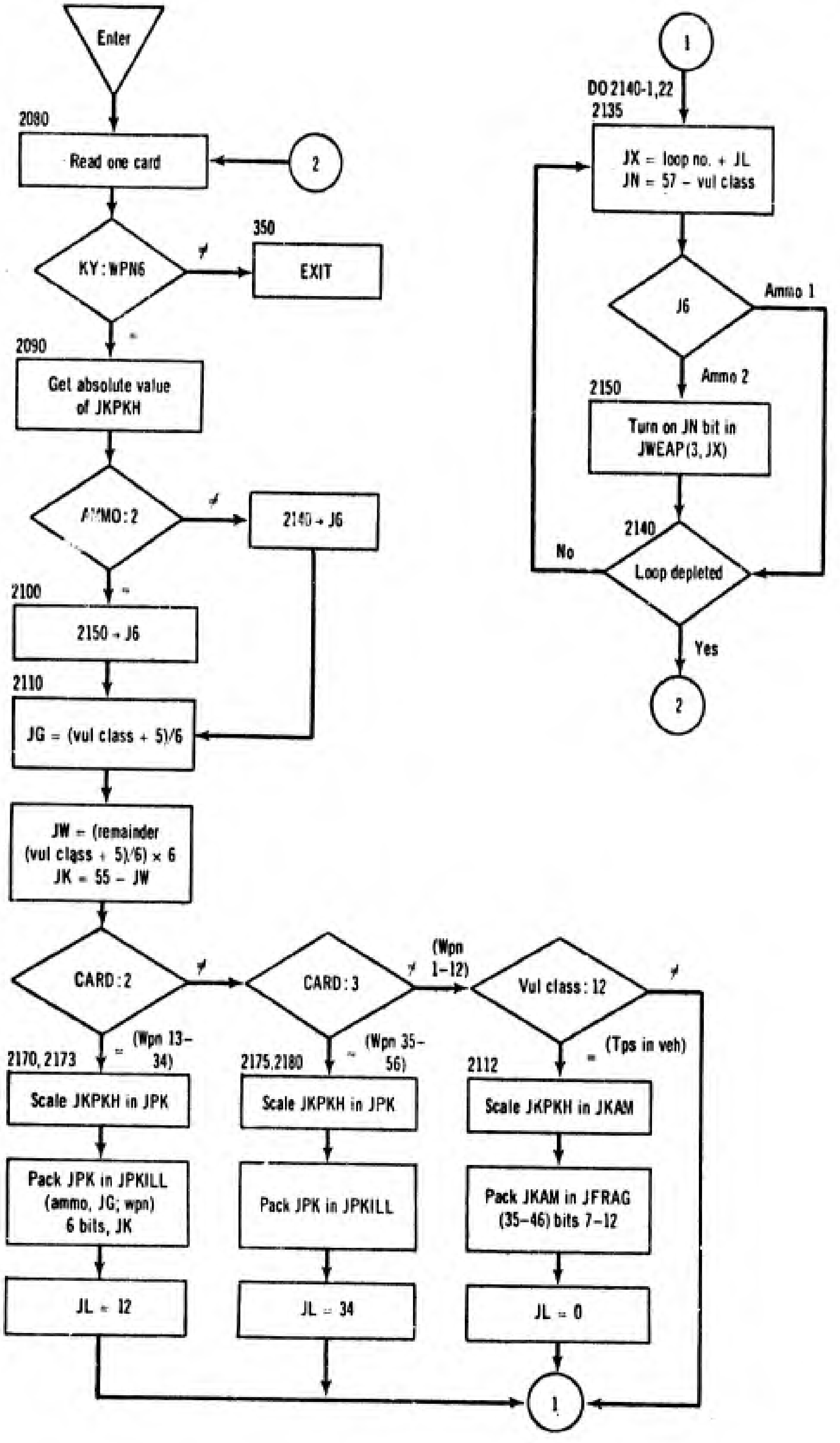
All cards process the preferred ammo type beginning with statement 2135. JL will have been set to the first weapon type minus one of this group. The DO 2140 loop turns on the proper bit (45-56) for the vulnerability class for which ammo 2 is preferred for the weapon in the third JWEAP word. Control then returns to statement 2080 to read the next card.

Card 1 is processed by the DO 2112 loop. Only vulnerability class 12, probability of survival of passengers in troop carrier is processed. The kill probability is scaled 2^6 and stored in words 35-46 of the proper side in JFRAG. JL is set to zero and control goes to statement 2135.

Card 2 processes weapon types 13-34. The DO 2173 loop scales the kill probability 2^6 and stores it in the first 22 words of JPKILL by ammo type and JG and JK (computed above). JL is set equal to twelve and control goes to statement 2135.

Card 3 processes weapon types 35-56 in DO 2180 similar to the processing of Card 2 input. Scaled probabilities are stored in the second 22 words of JPKILL. JL is set equal to thirty four and control goes to statement 2135.

Subroutine DTREAD
Input form Weapon 3



Enter
2080
Read one card
2
KY:WPN6
≠
350
EXIT
=
2090
Get absolute value of JKPKH
AMMO:2
≠
2140 → J6
=
2100
2150 → J6
2110
JG = (vul class + 5)/6
JW = (remainder (vul class + 5)/6) × 6
JK = 55 − JW
CARD:2
≠
CARD:3
≠
(Wpn 1–12)
Vul class:12
≠
2170, 2173
=
(Wpn 13–34)
Scale JKPKH in JPK
Pack JPK in JPKILL (ammo, JG; wpn) 6 bits, JK
JL = 12
2175,2180
=
(Wpn 35–56)
Scale JKPKH in JPK
Pack JPK in JPKILL
JL = 34
2112
=
(Tps in veh)
Scale JKPKH in JKAM
Pack JKAM in JFRAG (35–46) bits 7–12
JL = 0
1
1
DO 2140-1,22
2135
JX = loop no. + JL
JN = 57 − vul class
J6
Ammo 1
Ammo 2
2150
Turn on JN bit in JWEAP(3, JX)
2140
Loop depleted
No
Yes
2

Input Form Mobility 2, Subroutine DTREAD

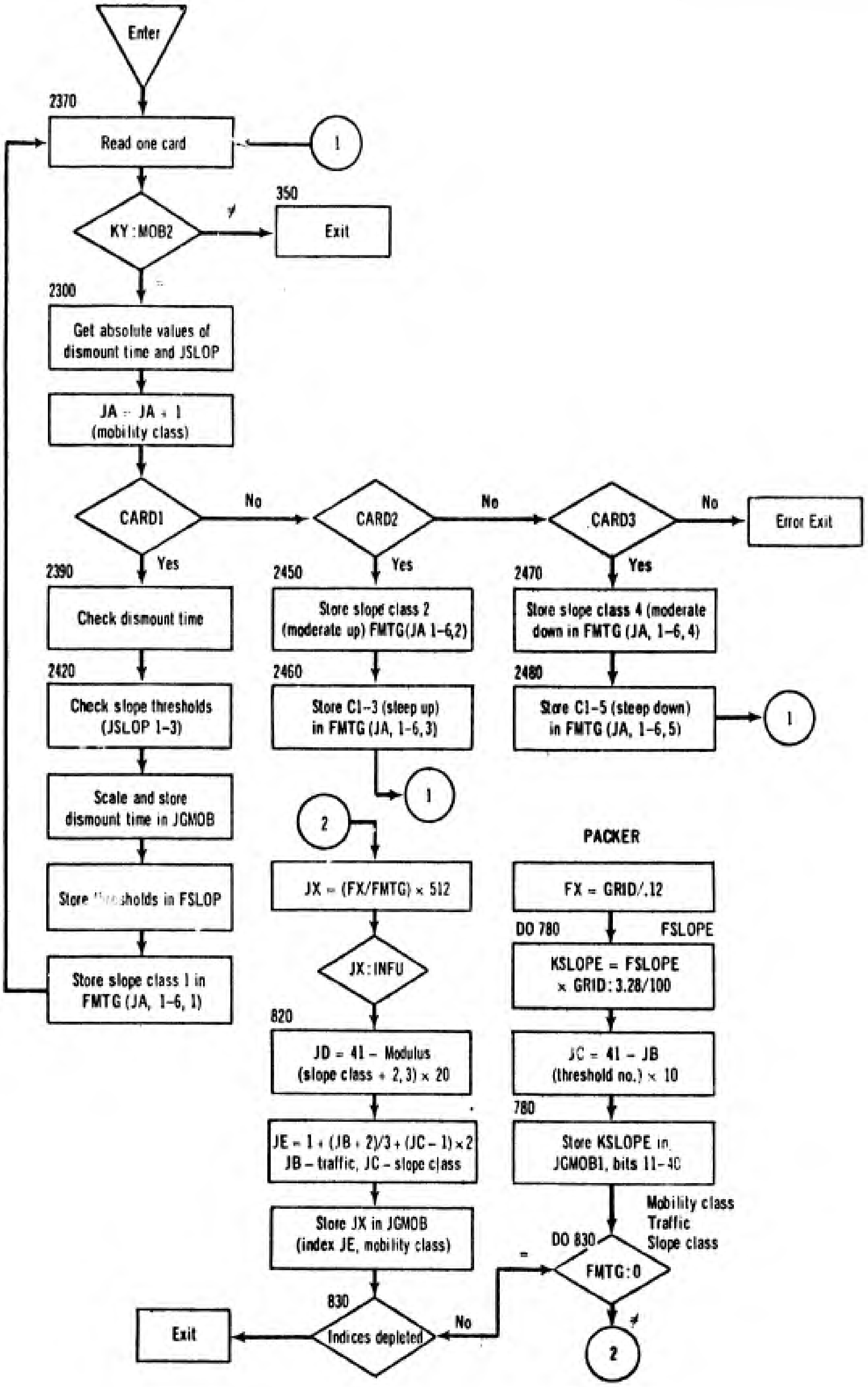
Dismount (also remount) time is scaled and stored in JGMOB(1, Mobility Class).

The three slope thresholds are stored in FSLOP (mobility class, threshold), DO 2430. FSLOP is in common INTER. At DO 2440 trafficability for slope class 1 is stored in FMTG (mobility class, trafficability, 1). FMTG is in common INTER. Card 2 is processed at DO 2460. Slope class 2 and 3 are stored in FMTG (mobility class, trafficability, 2 and 3). Card 3 is similarly processed at DO 2480 for slope class 4 and 5.

Processing continues in subroutine PACKER, (Overlay (1,1)). DO 780 multiplies the slope thresholds by GRID, scales by dividing by 100.0, and stored in JGMOB(1, mobility class).

FX has previously been set by $FX = \frac{GRID}{0.12}$. At DO 830, JX is computed equal to FX/FMTG, scaled 2^9, and is packed in JGMOB.

Subroutine DTREAD
Input form Mobility 2


Enter
2370
Read one card
1
KY:MOB2
≠
350
Exit
=
2300
Get absolute values of dismount time and JSLOP
JA = JA + 1 (mobility class)
CARD1
No
CARD2
No
CARD3
No
Error Exit
Yes
Yes
Yes
2390
Check dismount time
2450
Store slope class 2 (moderate up) FMTG(JA 1–6,2)
2470
Store slope class 4 (moderate down in FMTG (JA, 1–6, 4)
2420
Check slope thresholds (JSLOP 1–3)
2460
Store C1–3 (steep up) in FMTG (JA, 1–6, 3)
2480
Store C1–5 (steep down) in FMTG (JA, 1–6, 5)
1
1
Scale and store dismount time in JGMOB
2
PACKER
Store thresholds in FSLOP
JX = (FX/FMTG) × 512
FX = GRID/.12
DO 780
FSLOPE
JX:INFU
KSLOPE = FSLOPE × GRID:3.28/100
Store slope class 1 in FMTG (JA, 1–6, 1)
820
JD = 41 – Modulus (slope class + 2, 3) × 20
JC = 41 – JB (threshold no.) × 10
780
JE = 1 + (JB + 2)/3 + (JC – 1) × 2
JB – traffic, JC – slope class
Store KSLOPE in JGMOB1, bits 11–40
Store JX in JGMOB (index JE, mobility class)
Mobility class
Traffic
Slope class
DO 830
=
FMTG:0
830
Exit
Indices depleted
No
≠
2

TERGEN

Flow charts for the terrain generator and all of its subroutines follow. These routines read the terrain deck, check and list errors, print the terrain information, and, if no errors exist, punch the land deck.

The main program TERGEN executes the calling of the subroutines.

LMTS checks that all inputs are within the prescribed limits. If an error is discovered subroutine ERROR is called to print the error message.

LGR checks each set of coordinates of the input to determine if they are larger than the preceding set. If not subroutine ERROR is called.

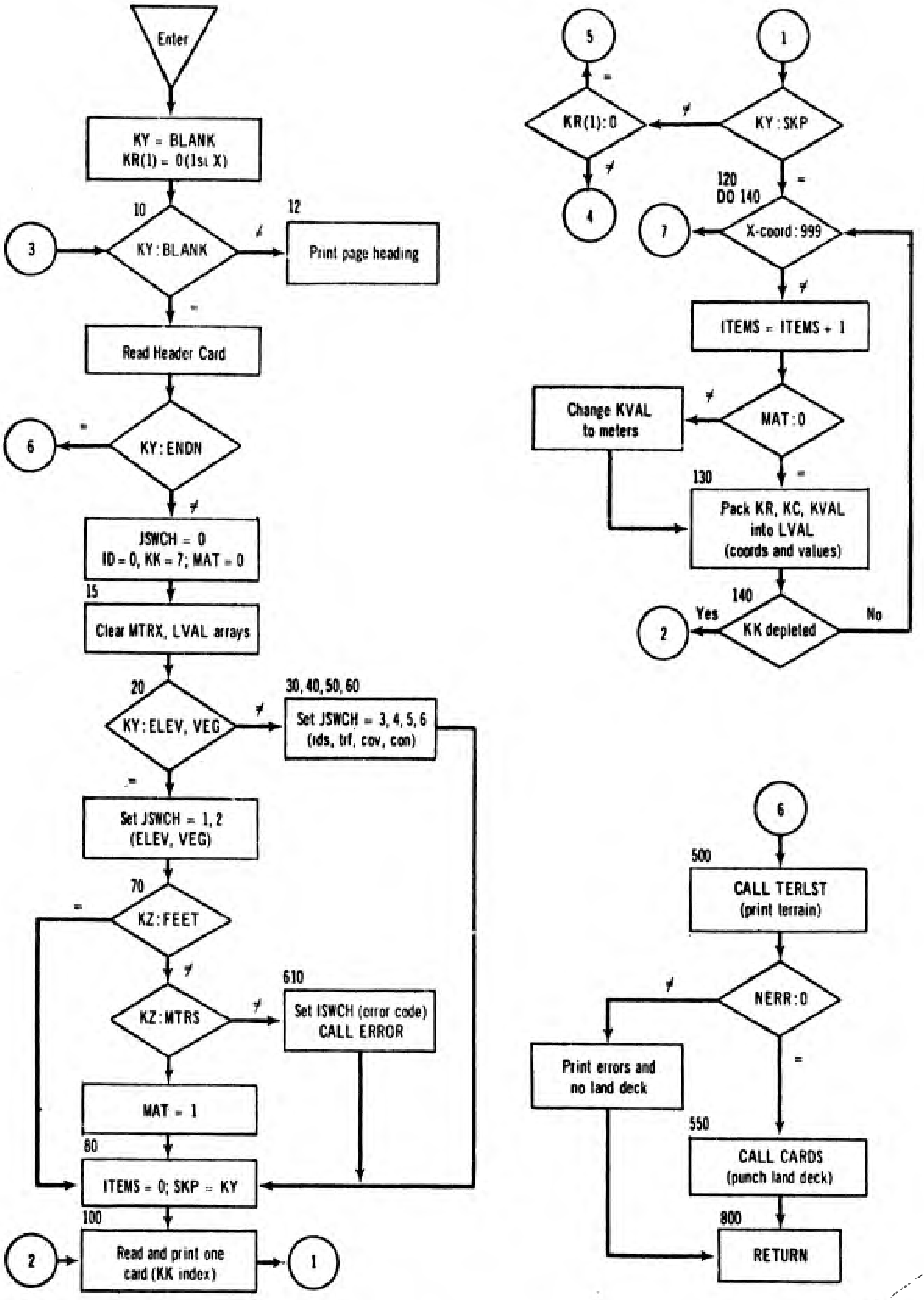
VALUE loads the proper values into squares whose coordinates were omitted.

PKTERR packs the JLAND array.

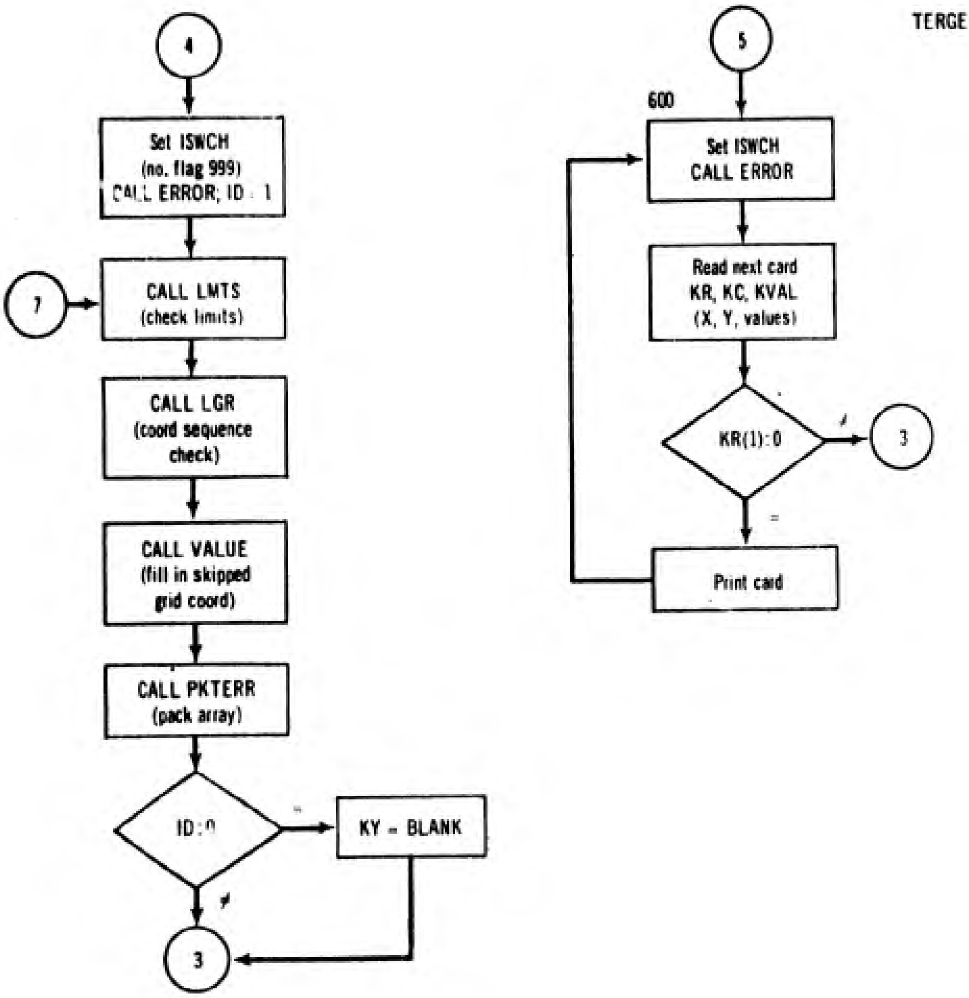
TERLST unpacks and lists the terrain characteristics for each grid.

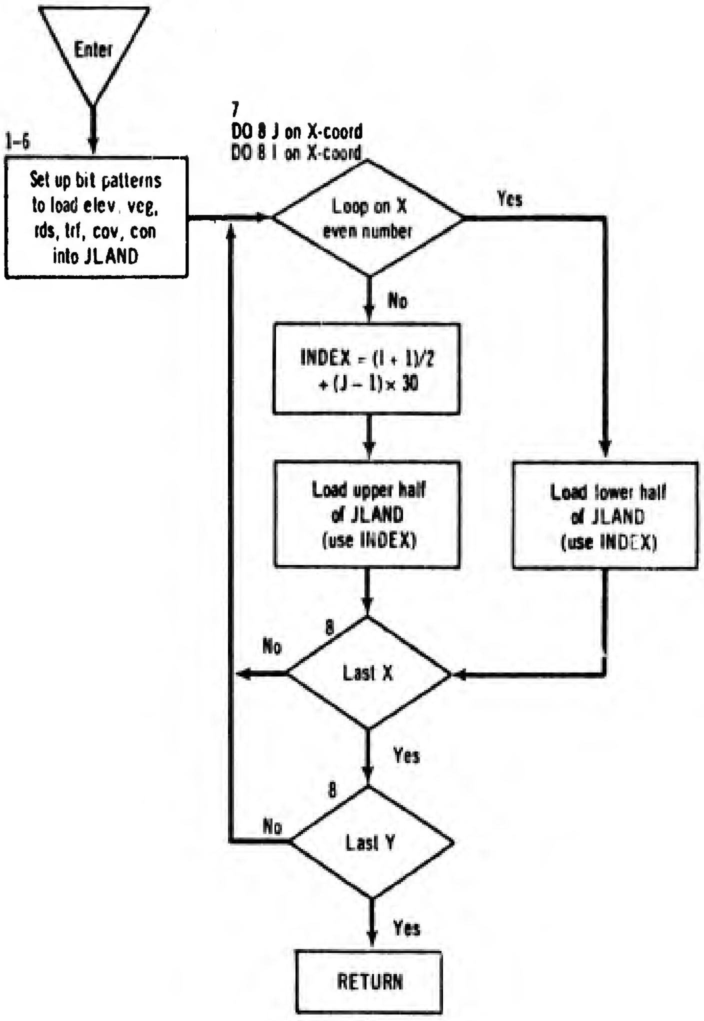
CARDS punches the land deck if no input errors were detected.

TERGEN OVLY(3,0) P.1

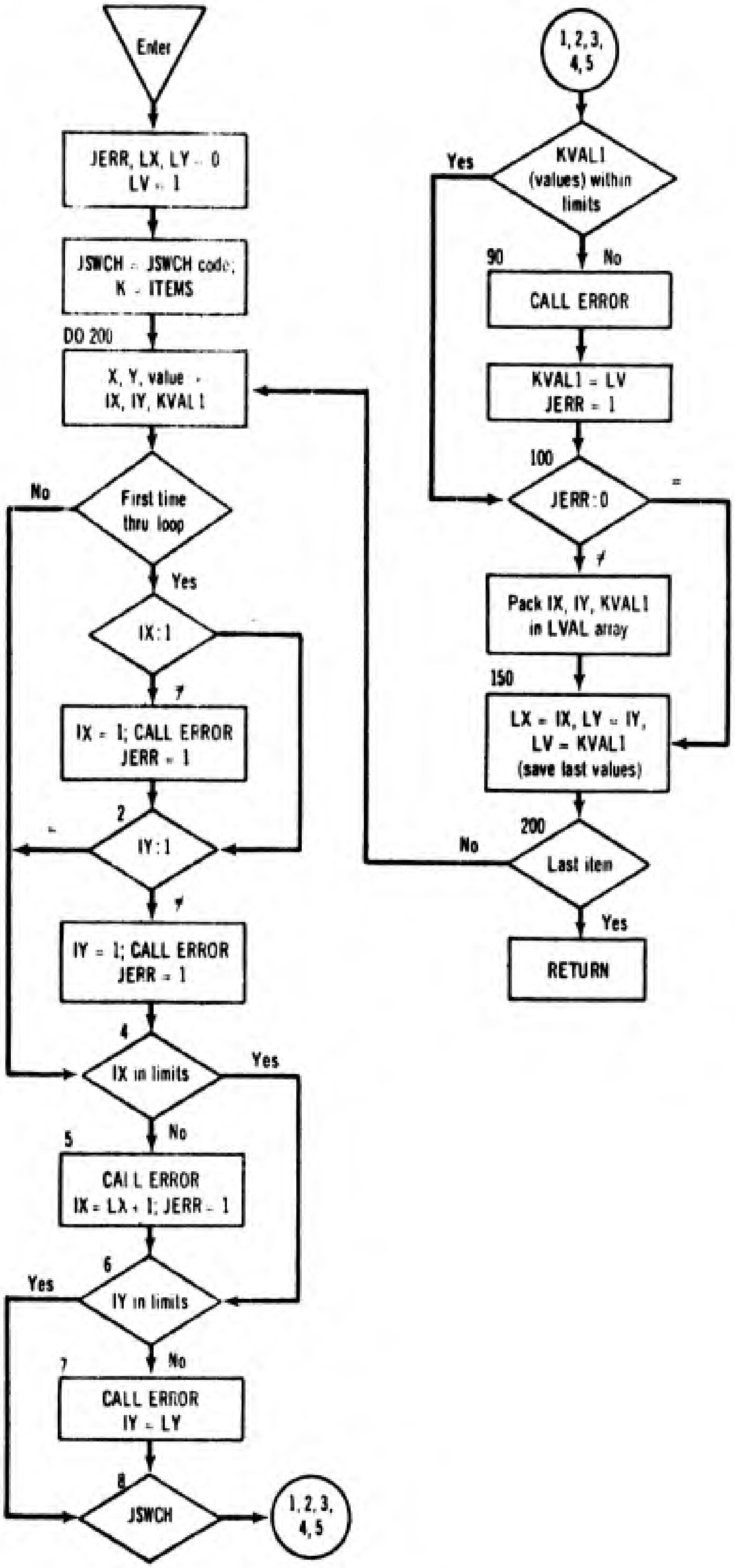

Enter
KY = BLANK
KR(1) = 0(1st X)
10
12
3
KY : BLANK
≠
Print page heading
=
Read Header Card
6
=
KY : ENDN
≠
JSWCH = 0
ID = 0, KK = 7; MAT = 0
15
Clear MTRX, LVAL arrays
20
30, 40, 50, 60
KY : ELEV, VEG
≠
Set JSWCH = 3, 4, 5, 6
(ids, trf, cov, con)
=
Set JSWCH = 1, 2
(ELEV, VEG)
70
=
KZ : FEET
≠
610
KZ : MTRS
≠
Set ISWCH (error code)
CALL ERROR
MAT = 1
80
ITEMS = 0; SKP = KY
100
2
Read and print one
card (KK index)
1
5
1
=
KR(1) : 0
≠
KY : SKP
≠
4
120
DO 140
=
7
X-coord : 999
≠
ITEMS = ITEMS + 1
Change KVAL
to meters
≠
MAT : 0
130
=
Pack KR, KC, KVAL
into LVAL
(coords and values)
140
2
Yes
KK depleted
No
6
500
CALL TERLST
(print terrain)
≠
NERR : 0
Print errors and
no land deck
=
550
CALL CARDS
(punch land deck)
800
RETURN

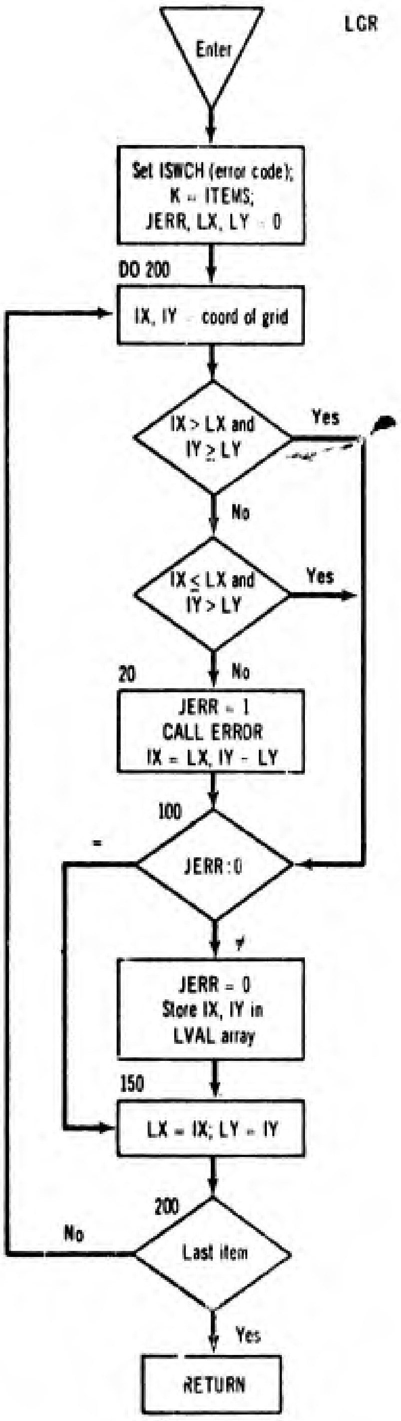
TERGEN P.2


4
Set ISWCH
(no. flag 999)
CALL ERROR; ID = 1
7
CALL LMTS
(check limits)
CALL LGR
(coord sequence
check)
CALL VALUE
(fill in skipped
grid coord)
CALL PKTERR
(pack array)
ID:0
=
KY = BLANK
≠
3
5
600
Set ISWCH
CALL ERROR
Read next card
KR, KC, KVAL
(X, Y, values)
KR(1):0
≠
3
=
Print card


Enter
1–6
Set up bit patterns to load elev. veg, rds, trf, cov, con into JLAND
7
DO 8 J on X-coord
DO 8 I on X-coord
Loop on X even number
Yes
No
INDEX = (I + 1)/2 + (J – 1) × 30
Load upper half of JLAND (use INDEX)
Load lower half of JLAND (use INDEX)
8
No
Last X
Yes
8
No
Last Y
Yes
RETURN

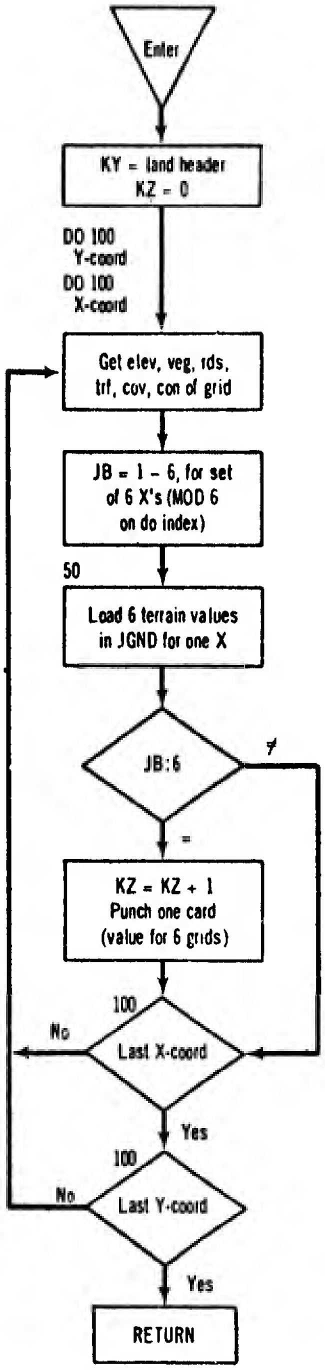
LMTS


Enter
JERR, LX, LY = 0
LV = 1
JSWCH = JSWCH code;
K = ITEMS
DO 200
X, Y, value →
IX, IY, KVAL1
No
First time
thru loop
Yes
IX : 1
≠
IX = 1; CALL ERROR
JERR = 1
2
IY : 1
≠
IY = 1; CALL ERROR
JERR = 1
4
IX in limits
Yes
No
5
CALL ERROR
IX = LX + 1; JERR = 1
6
Yes
IY in limits
No
7
CALL ERROR
IY = LY
8
JSWCH
1, 2, 3,
4, 5
1, 2, 3,
4, 5
Yes
KVAL1
(values) within
limits
90
No
CALL ERROR
KVAL1 = LV
JERR = 1
100
JERR : 0
=
≠
Pack IX, IY, KVAL1
in LVAL array
150
LX = IX, LY = IY,
LV = KVAL1
(save last values)
200
No
Last item
Yes
RETURN



LGR

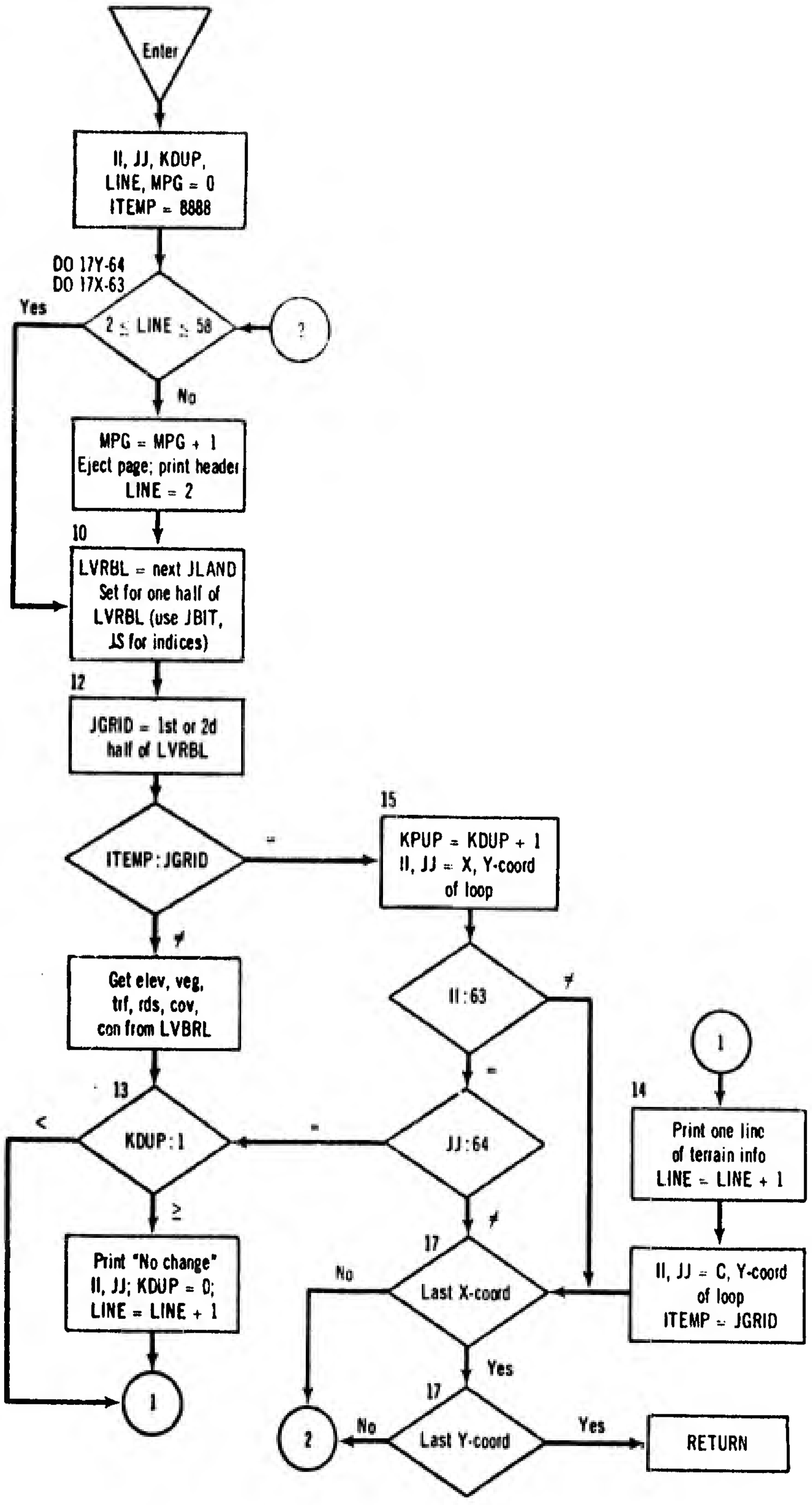
Enter
Set ISWCH (error code); K = ITEMS; JERR, LX, LY = 0
DO 200
IX, IY = coord of grid
IX > LX and IY ≥ LY
Yes
No
IX ≤ LX and IY > LY
Yes
No
20
JERR = 1
CALL ERROR
IX = LX, IY = LY
100
JERR : 0
=
≠
JERR = 0
Store IX, IY in LVAL array
150
LX = IX; LY = IY
200
Last item
No
Yes
RETURN



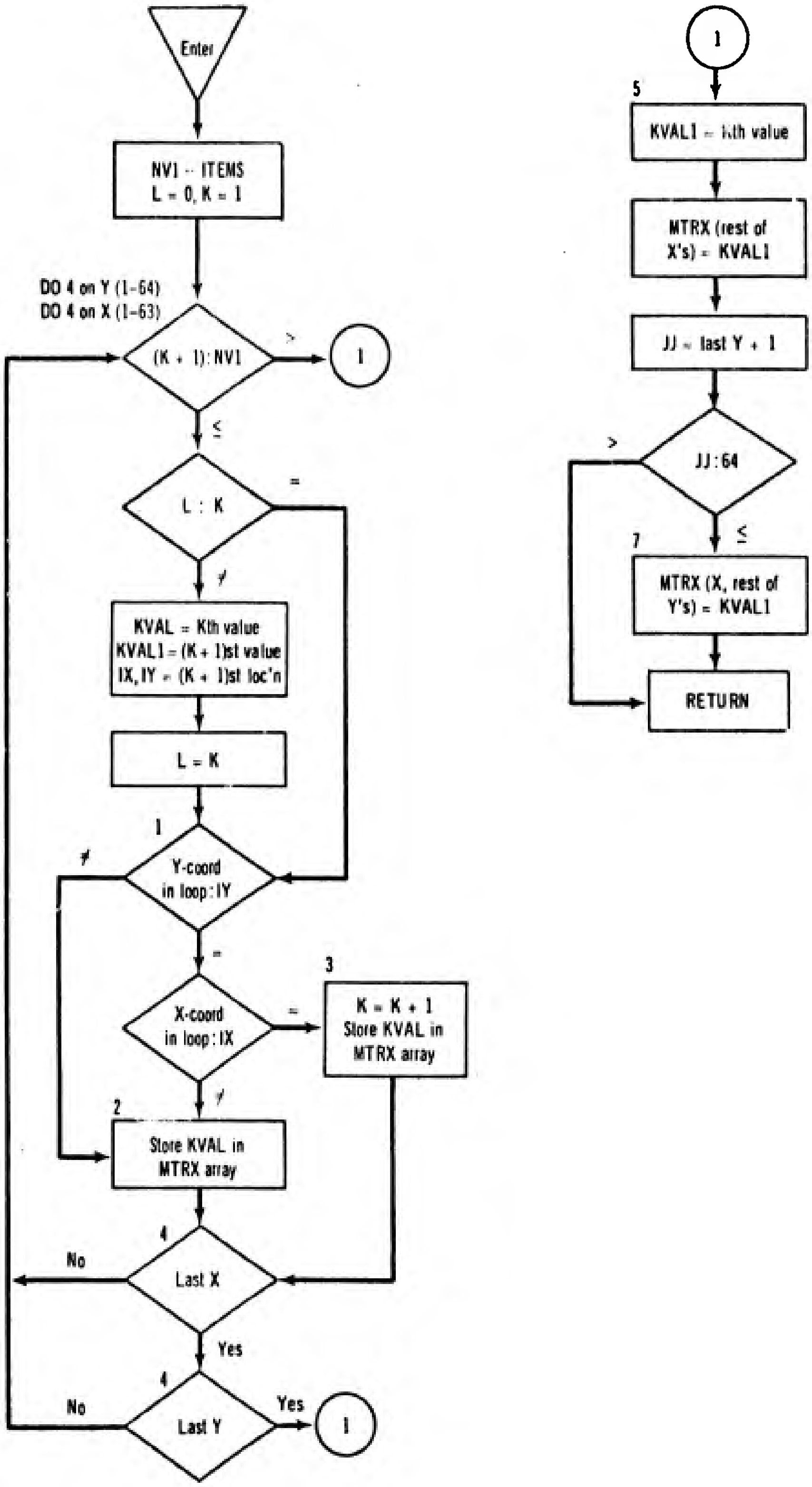
CARDS

Enter
KY = land header
KZ = 0
DO 100 Y-coord
DO 100 X-coord
Get elev, veg, rds, trf, cov, con of grid
JB = 1 – 6, for set of 6 X's (MOD 6 on do index)
50
Load 6 terrain values in JGND for one X
JB : 6
≠
=
KZ = KZ + 1
Punch one card
(value for 6 grids)
100
Last X-coord
No
Yes
100
Last Y-coord
No
Yes
RETURN

TERLST


Enter
II, JJ, KDUP, LINE, MPG = 0 ITEMP = 8888
DO 17Y-64
DO 17X-63
Yes
2 ≤ LINE ≤ 58
2
No
MPG = MPG + 1 Eject page; print header LINE = 2
10
LVRBL = next JLAND Set for one half of LVRBL (use JBIT, JS for indices)
12
JGRID = 1st or 2d half of LVRBL
ITEMP : JGRID
=
15
KPUP = KDUP + 1 II, JJ = X, Y-coord of loop
≠
Get elev, veg, trf, rds, cov, con from LVBRL
II : 63
≠
=
1
14
Print one line of terrain info LINE = LINE + 1
13
<
KDUP : 1
=
JJ : 64
≥
≠
Print "No change" II, JJ; KDUP = 0; LINE = LINE + 1
17
No
Last X-coord
II, JJ = C, Y-coord of loop ITEMP = JGRID
Yes
17
1
2
No
Last Y-coord
Yes
RETURN

VALUE


Enter
NV1 = ITEMS
L = 0, K = 1
DO 4 on Y (1-64)
DO 4 on X (1-63)
(K + 1) : NV1
>
1
≤
L : K
=
≠
KVAL = Kth value
KVAL1 = (K + 1)st value
IX, IY = (K + 1)st loc'n
L = K
1
Y-coord
in loop : IY
≠
=
X-coord
in loop : IX
=
3
K = K + 1
Store KVAL in
MTRX array
≠
2
Store KVAL in
MTRX array
4
No
Last X
Yes
4
No
Last Y
Yes
1
1
5
KVAL1 = Kth value
MTRX (rest of
X's) = KVAL1
JJ = last Y + 1
>
JJ : 64
≤
7
MTRX (X, rest of
Y's) = KVAL1
RETURN

Part II

BATTLE MODEL

The Battle Model is an event model which performs the actual simulation of combat. It produces a file of event messages which must then be processed by the Post Processor.

LABELED COMMON

The labeled commons which appear in more than one subroutine are described below. Description includes name of the labeled common, the deckname, subroutines it is called by and a discussion of each variable and array.

The following labeled commons are included:

1 CHNGE*
2 CLAR
3 CLOCK*
4 CNTL*
5 COMM
6 HSTDAT
7 IMPFIR*
8 MAIN
9 RUN*
10 SURVEL*
11 TERRAN*
12 TGTSL*
13 TREAT*
14 WORK

---

*These are * CALLS in the CDC 6400 system.

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(1) Labeled Common CHNGE - Deckname CCHNGE

Used by subroutines FIRING, IMPACT, ASSESS, NEWMIS, and CHANGE.

LSMCHK - Number of remaining volleys to be fired under the current order.

LAMWA - Ammunition available (types 1 and 2) for current weapon. These are actually used as local variables in all subroutines except CHANGE.

(2) Labeled Common CLAR

Used by CLARTY, DESTGT

(3) Labeled Common CLOCK - Deckname CLOCK

Used by EXECJK, MAIN2X, EXEC2, LOWCLK, DEAD, BMOUNT.

JCLOCK(63,2) - Contains the lowest clock for all units (48 weapons and 15 commands) for both sides. Set in subroutine LOWCLK.

(4) Labeled Common CNTRL - Deckname CONTRL

Used by most subroutines.

Start - Flag word set in EXECJK and MAIN2X, =0 the first treatment is to be processed, =1 end of replication data is to be processed and check is to be made if another treatment is to be processed, =2 last replication of last treatment has been completed.

ZERO - The constant zero.

NEWPERM - The number of data words in MAIN Common (TAPE2).

IZAP - Overlay identifier.

INFL - Lower infinity (a clock time, meaning available).

INFU - Upper infinity (a clock time, meaning unavailable).

NSWCH - If other than zero, current run is a debugging run.

NOW - Battle time to start debugging output.

LATER - Battle time to stop debugging output.

The above are loaded or initialized in BLOCK DATA BATTLE. NSWCH, NOW, LATER if non-zero are loaded from the input control card (see Appendixes A and B).

(5) Labeled Common COMM

Used by DECIDE, COMMO, OPFRST, DGFRST

(6) Labeled Common HISDAT

Used by most routines.

(7) Labeled Common IMPFIR - Deckname FIRIMP

Used by subroutines FIRING and IMPACT.

IWASAT(48,2),(2,48,2-UNIVAC); Packed coordinates of firer at time of firing. Loaded in FIRING and checked in IMPACT. This is necessary in case unit moves into or over another square between firing and impact, so that correct range is passed on to the post processor.

6400 bit no.	1108 bit no.		Description	
	Word 1	Word 2		
48-43		7-12	X	for Weapon 4
42-37		1-6	Y	
36-31	31-35	0	X	for Weapon 3
30-25	25-30		Y	
24-19	19-24		X	for Weapon 2
18-13	13-18		Y	
12-7	7-12		X	for Weapon 1
6-1	1-6		Y	

(8) Labeled Common MAIN

Used by most routines. See Appendix D.

(9) Labeled Common RUN - Deckname CRUN

Used by subroutines EXECJK, HSTOUT, MAIN2X, EXEC2, STOP1, STOP2, STOP3.

KMAX - Maximum minutes of battle time per replication.
NR - Number of replications to play.
KN - The seed for the first random number.
NT - Treatment number to play.

KX - An X-coordinate on the battlefield.

KY - An Y-coordinate on the battlefield.

KDIS - A distance in meters.

KSIDE - A side, blue = 1, red = 2.

KUNITS - The number of units.

(KX thru KUNITS establish battle stopping conditions prior to maximum time).

KREDFC - The number of red casualties(personnel) to stop the game.

KBLUFC - The number of blue casualties(personnel) to stop the game..

KSTAY - Not used.

KSTRN - Last random number this replication.

NRP - Current replication number.

KREDVC - The number of red vehicle casualties to stop the game.

KBLUVC - The number of blue vehicle casualties to stop the game.

KSTRN and NRP are loaded in MAIN2X, all others are inputs from the Battle Model control cards.

(10) Labeled Common SURVEL - Deckname CSURV

Used by subroutines SURV, COMMO, TGTACQ, and PRORTG.

M12(48), M13(48), M14(48) - Enemy is known by unit being processed to Nearest Square, Erroneous Pinpoint, or Pinpoint, Logical Arrays.

IXTA(48), IYTA(48) - Coordinates of all enemy unit locations.

LDEAD(48) - Logical array. Knowledge of enemy units being dead.

LWCLK(4) - Weapon clocks for units weapons. (Maximum 4)

LSC, LST - Sensor class and type being processed.

MINSRG, MAXSRG - Minimum and maximum range of sensor.

*ILOS - Units in LOS (by bits).

LTI - Probability of loss of NS information on target.

*JCDET - NS information for command units.

---

*Dimensional 2 for the UNIVAC version.

*JCDEAD - Knowledge of enemy dead for command units (by bits).

INDEX - A command unit's number (49-63, incl) as distinguished from its buddy unit's number.

ICOMMO - Set = 1 if any enemy units are on EPP list. This signals call to subroutine COMMO.

*INTLNS - Bit is on for all enemy units known to NS, are in LOS, and not known to be dead.

MZ(48) - Logical array. If TRUE surveillance is performed against this unit.

All variables are set or loaded in SURV except ICOMMO, which is set in TGTACQ.

(11) Labeled Common TERRAN - Deckname CTERAN

Used by subroutines KONCOV, TERRA, LOS, MOVE, IMADET, VISDET, and BDMONT.

This common contains information on the square being checked as follows:

LELEV - Elevation
LVEG - Height of vegetation
LROAD - Road index
LTRAF - Cross-country trafficability index
LCOV - Cover index
LCON - Concealment index.

All are loaded in subroutine TERRA.

(12) Labeled common TGTSL - Deckname CTGTSL

Used by subroutines TGTSEL, CLARTY, OPFRST, DESTGT, DGFRST.

IXTT(48), IYTT(48) - Coordinates of all enemy units. Loaded in TGTSEL.

Logical arrays and variables, all set in TGTSEL.

MX(48) - Enemy units known to have fired at this unit and to which this unit is seriously or moderately vulnerable. Used for weapon unit to call artillery.

MX1(48) - Same as MX(48).

MX2(48) - Enemy units known to have fired at this unit or friends and to which this unit is seriously or moderately vulnerable.

MX3(48) - Enemy units to which this unit is invulnerable.

MT1(48) - Enemy units that have fired at this unit.

MT2(48) - Enemy units that are known to have fired at friendly units.

MT3(48) - Enemy units that are not known to have fired but that are EPP.

ITL(48) - Enemy units in LOS and EPP.

ITL1(48) - ITL and within 2 squares of target.

MV1(48) - Enemy units to which this unit is seriously vulnerable.

MV2(48) - Enemy units to which this unit is moderately vulnerable.

MI2(48) - Enemy units known to NS.

MI3(48) - Enemy units on EPP list.

MTL1(48) - Enemy units in LOS, on EPP list, and within range.

MTL2(48) - Enemy unit in MTL1 list known to have fired at this unit and to which this unit is seriously or moderately vulnerable, and on priority list of this unit.

MTL3(48) - Enemy units on MTL2 list and to which this unit is seriously vulnerable.

LDEAD(48) - Enemy units known dead.

LLEE(48) - Enemy units know to have fired at this unit.

LKEE(48) - Enemy units known to have fired at friendly units.

MCVTS(16,3), MCVTM(16,3) - Enemy target class to whcih this unit is seriously or moderately vulnerable, in each of three range brackets.

LFR1 - Unit is pinned down.

LFR2 - Unit is partially neutralized by direct fire.

LFR3 - Unit is partially neutralized by indirect fire.

LKA2 - Not used.

(13) Labeled Common TREAT - Deckname CTREAT

Used by subroutines EXECJK, MAIN2X, EXEC2, DECIDE, TGTSEL, IMPACT, MOVE, RADAR, IMADET, VISDET, TERPLA, DESTGT.

ICLKU - Not used.

ICLKN - Neutralization clock. Set and incremented in EXEC2.

INTU - Not used.

INTN - Neutralization interval. Input from Unit 5.

KATIME - Assessment interval. Input from Mobility 1.

KCTIME - Decision cycle. Input from Mobility 1.

KSVRN - Near range, danger state table. Input from Unit 4.

KSVRF - Far range, danger state table. Input from Unit 4.

JRDF - Radar degradation factor.

SIGS - Scattering coefficient.

SIGA - Absorption coefficient.

KOND - Light level condition, starlight-1, moonlight-2, part moon-3.

DIM(16) - Minimum target dimension target classes 1-16. Nine bits each target class, stored XX X. (See Appendix D.)

JVISAN(31,2) - Contrast constants. See JVISA in Appendix D.

DMAG(6) - Magnification of devices 1-6, stored XX X. (See Appendix D.)

KWER(2) - White eye (hold fire) range, Blue and Red input from Unit 2.

LASQ(2) - Suppressive fire area, Blue and Red. Input from Weapon 5.

(14) Labeled Common WORK

Used by IMADET, VISDET.

EXECJK (Overlay (0,0))

Purpose: EXECJK is the main program in Overlay (0,0) which controls the entire model.

Arguments: Labeled common MAIN, RUN, CNTRL, CLOCK, TREAT

Called by: Not applicable.

The variable START is initiated by being set to zero. The first replication of the first treatment is initialized by calling Overlay (1,0) MAIN2X. After initialization of the first replication, Overlay (2,0) is called. EXEC2 controls Overlay (2,0) which is the main part of the battle model. At the completion of the first replication, START is set equal to one and Overlay (1,0) MAIN2X is re-entered, and writes the end of replication data on tape 4 and initializes the next replication. Since START is not equal to two, control goes to statement 10 and Overlay (2,0) EXEC2 is called again. If an end of treatment (last replication of the treatment) is encountered while in Overlay (1,0) MAIN2X the first replication of the next treatment is initialized without returning to this overlay. When processing of the last treatment is finished (the flag card read), Overlay (1,0) MAIN2X sets START equal to two and upon return the run is stopped.

MAIN2X

Purpose: This program is overlay (1,0). It reads the input tape and cards and initializes all master clocks, control clocks, and surveillance clocks, and writes the output tape.

Arguments: Labeled common MAIN, RUN, CNTRL, CLOCK, TREAT.

Called by: Overlay (0,0) (EXECJK)

If START equals one, indicating end of replication, control goes to statement 80 where the last random number is stored in KSTRN and history for end of replication for all units is stored. If this was the last replication, history for end of treatment is stored and control goes to statement 10. If this was not the last replication, the replication count, NRP, is incremented and control goes to statement 30. START is set to zero in EXECJK before the first cell to this overlay and to one after return.

If START does not equal one, control goes to statement 10 and an input control card is read, checked, and printed. If the treatment number is 9999 (the flag), control goes to statement 130, where start is set equal to two, end of file is written on the output tape (tape 4), tape 4 is rewound and control is returned to the zero overlay.

If the treatment number is not the flag, ABUG information is stored in NSWCH, NOW, and LATER. The maximum battle time is scaled 2^{12} and stored in KMAX, the replication count, NRP, set to one, and the random number seed stored in KSTRN. At statement 30 the first record of the input tape (tape 2) is read. This will contain labeled common MAIN. If the treatment number on the tape is 9999 control goes to statement 130. If the treatment number is not the flag, it is compared with the treatment to be processed (from the input control card). If this is not the treatment to be processed control goes to statement 30 to read the next record. If this is the treatment to be processed and this is the first replication, the proximity distance is stored in KDIS (in grids squared), and begin treatment message is stored. If this is not the first replication, KDIS storing and begin treatment is bypassed. The input tape is rewound and the random number, (KSTRN) is stored in NUMR, the current random number seed. The casualty stopping counters for both men and vehicles are set to zero; these will be incremented in IMPACT. Assessment and decision cycle time are stored in KATIME and KCTIME. The neutralization interval time is scaled 2^9 and stored in INTN. It is then stored in the neutralization clock, ICLKN, to set the time for the first call to NEUT. The near and far vulnerability range for danger state thresholds are extracted from JMISC into KSVRN and KSVRF. The hold fire (white eye) range and suppressive fire search radius for each side are extracted from JSIDEP into KWER and LASQ.

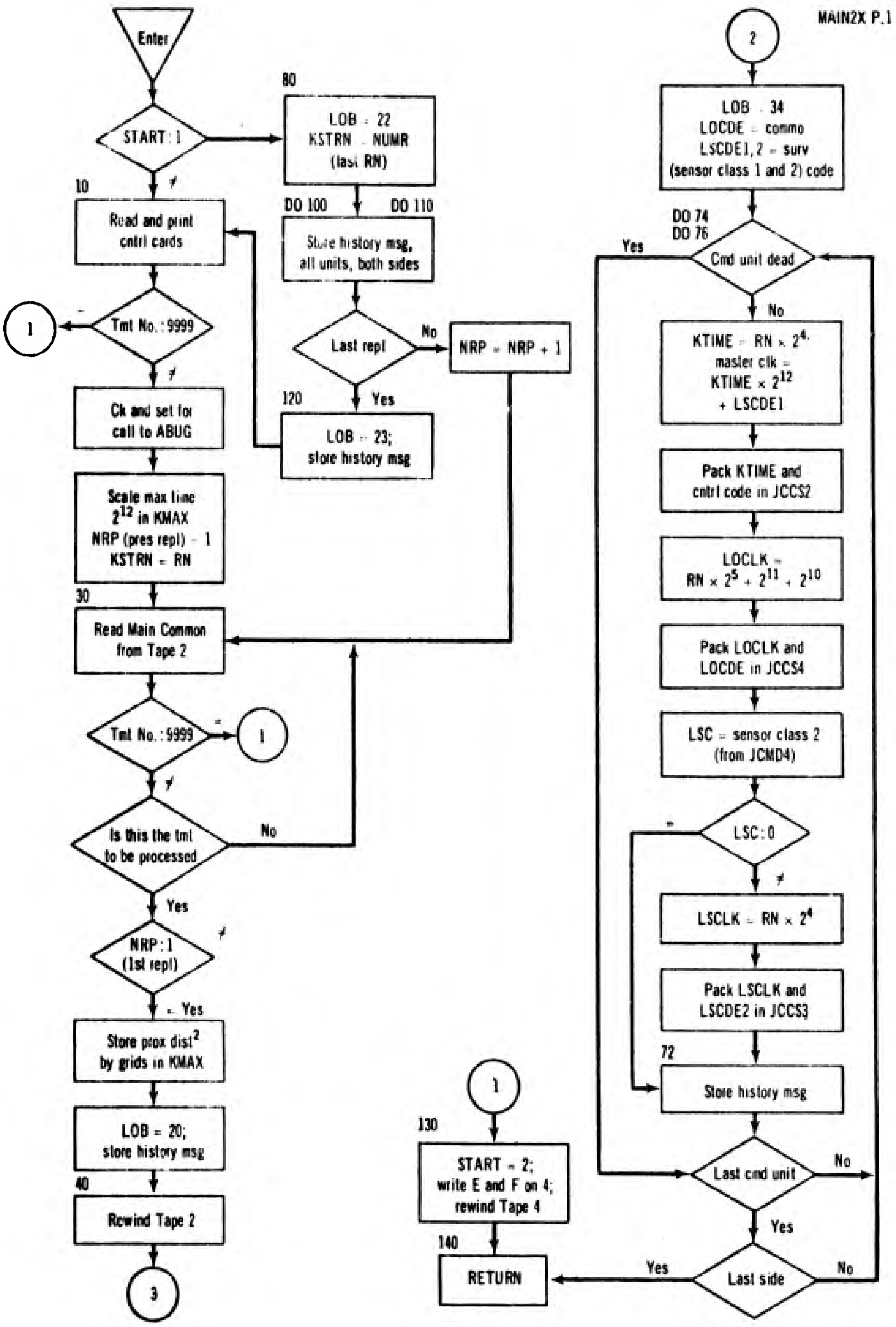
Parameters for subroutines RADAR, IMADET, VISDET, and TERPLA are scaled and stored at statements 41-49.

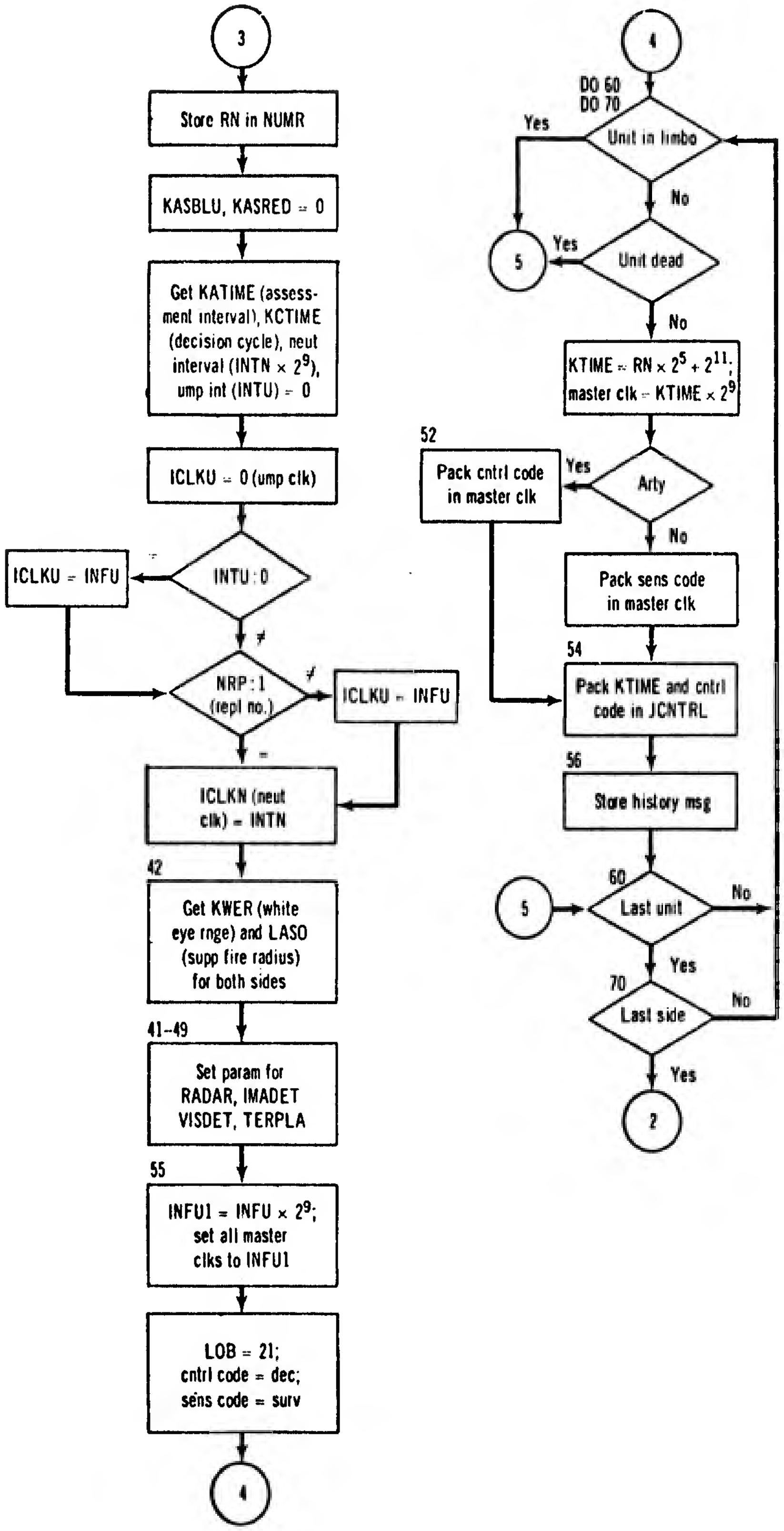
The DO 55 loop sets all master clocks to upper infinity scaled 2^9. The LOB is set for begin replication. LCCDE, control code, is set to zero (decision) and LSCDE, sensor code, is set to 25 (surveillance) for the unit's sensor number 1.

The DO 70, DO 60 loops set initial times, KTIME, for each unit by a random number scaled 2^5 and increased by 2^{11}. KTIME is then scaled 2^9 and stored in the units master clock. The code LSCDE is then added to the master clock for all units except artillery, and LCCDE for artillery units. KTIME and LCCDE are inserted in the control clock and code in JCNTRL for all units, and the begin replication history message stored for each unit. Mounted units (in limbo) and dead units are not processed; their master clocks stay at upper infinity.

The command units are then processed. LOCDE is set to the communications code (40). LSCDE1 and LSCDE2 are set for surveillance for the units sensor numbers 1 and 2. KTIME for each unit is set by a random number scaled 2^4. The master clock is set by scaling KTIME by 2^9 and adding LSCDE1. KTIME and LCCDE are packed in control time and code in JCCS. The communications clock is set by a random number scaled 2^5 and increased by 3072 (6000 octal). The communications clock and code are packed in the fourth word of JCCS. JCMD is checked to determine if the command unit has a second sensor. If it does LSCLK is set by KTIME plus a random number scaled 2^4. LSCLK and LSCDE2 are packed in surveillance device number 2 clock and code in JCCS. Control then returns to Overlay (0,0) EXECJK.

There are no history messages printed by the post processor for begin or end replication or treatment. For begin and end replication, initial and final conditions are stored for the summaries. Begin and end treatment is a marker indicating the treatment number and the number of replications run.


MAIN2X P.1
Enter
START : 1
80
LOB = 22
KSTRN = NUMR
(last RN)
≠
10
Read and print
cntrl cards
DO 100
DO 110
Store history msg,
all units, both sides
−
Tmt No. : 9999
1
≠
Last repl
No
NRP = NRP + 1
120
Yes
Ck and set for
call to ABUG
LOB = 23;
store history msg
Scale max time
2^{12} in KMAX
NRP (pres repl) = 1
KSTRN = RN
30
Read Main Common
from Tape 2
Tmt No. : 9999
=
1
≠
Is this the tmt
to be processed
No
Yes
NRP : 1
(1st repl)
≠
= Yes
Store prox dist^2
by grids in KMAX
LOB = 20;
store history msg
40
Rewind Tape 2
3
2
LOB = 34
LOCDE = commo
LSCDE1, 2 = surv
(sensor class 1 and 2) code
DO 74
DO 76
Yes
Cmd unit dead
No
KTIME = RN × 2^4·
master clk =
KTIME × 2^{12}
+ LSCDE1
Pack KTIME and
cntrl code in JCCS2
LOCLK =
RN × 2^5 + 2^{11} + 2^{10}
Pack LOCLK and
LOCDE in JCCS4
LSC = sensor class 2
(from JCMD4)
=
LSC : 0
≠
LSCLK = RN × 2^4
Pack LSCLK and
LSCDE2 in JCCS3
72
Store history msg
1
130
START = 2;
write E and F on 4;
rewind Tape 4
Last cmd unit
No
Yes
140
RETURN
Yes
Last side
No


3
Store RN in NUMR
KASBLU, KASRED = 0
Get KATIME (assessment interval), KCTIME (decision cycle), neut interval (INTN × 2^9), ump int (INTU) = 0
ICLKU = 0 (ump clk)
INTU : 0
ICLKU = INFU
≠
NRP : 1 (repl no.)
≠
ICLKU = INFU
=
ICLKN (neut clk) = INTN
42
Get KWER (white eye rnge) and LASO (supp fire radius) for both sides
41–49
Set param for RADAR, IMADET VISDET, TERPLA
55
INFU1 = INFU × 2^9; set all master clks to INFU1
LOB = 21; cntrl code = dec; sens code = surv
4
4
DO 60
DO 70
Yes
Unit in limbo
No
Yes
5
Unit dead
No
KTIME = RN × 2^5 + 2^11; master clk = KTIME × 2^9
52
Pack cntrl code in master clk
Yes
Arty
No
Pack sens code in master clk
54
Pack KTIME and cntrl code in JCNTRL
56
Store history msg
60
5
Last unit
No
Yes
70
Last side
No
Yes
2

CLOCKS AND SUBROUTINE LOWCLK

The entire sequence of events in the CARMONETTE simulation is controlled by the clocks and the event code associated with the clocks. The clocks indicate the time that an event will occur, the time requiring 21 bits of a word, the imaginary octal point being after the ninth bit, and the event code requiring 9 bits. Thus in the CDC 6400, two clocks and codes can be packed in a single word. Two words are used in the UNIVAC version.

The following clocks and codes are stored in the JCNTRL array for each weapon unit.

Clock	Code
Control (LCCLK)	(LCCDE) Decision, Boundary Crossing, End Dismount, Change Altitude, and End Remount.
Tactic (LTCLK)	(LTCDE) Tactic (which sets up the call to NEWMIS), and Out of Ammo.
Surveillance (LSCLK) There are two surveillance or sensor clocks available.	(LSCDE) The code will cause a call to subroutine SURV.

There are eight weapon clocks, one event clock and one loading clock, for each of four possible weapons.

Weapon Event (LWCLK)	(LWCDE) Target Select, End Aiming (Firing), Impact, and Assess.
Loading (LLCLK)	(LLCDE) End Loading (firing, but in this case firing may be delayed for impact or aiming).

Each command unit has four usable clocks packed in its JCCS array; the control clock, which is associated only with the decision code, two surveillance clocks, and communications clock and code which controls the call to subroutine COMMO. The latter subroutine may be called by a weapon unit; however such a call is not controlled by the clock.

In addition there is a Master Clock array, JCLOCK(63,2), which contains the Master Clock for each weapon and command unit for both sides. The Master Clock will always contain the lowest of the unit's clocks and its associated code. Subroutine LOWCLK checks all clocks of the unit being processed and transfers its lowest clock into its Master Clock.

Clocks are continually being reset during the program. When an event is to be processed, the current time (KTIME) is set to the event time. If a weapon fires, its LWCLK is set equal to KTIME plus time of flight of the projectile, and LWCDE is set to impact.

Routine EXEC2 selects the lowest of the Master Clocks, and the event code determines the routing to the appropriate subroutine. Surveillance and control clocks are inialized by randomizing in MAIN2X.

Two clock settings do not control an event. They are upper infinity, INFU, and lower infinity, INFL. INFU is used primarily to show that a unit is dead or a weapon out of ammunition. INFL for a weapon event clock indicates the weapon is available.

Subroutine LOWCLK is called by EXEC2, IMPACT, ASSESS, BDMONT, CLARTY, CLHCPR, CHANGE, DEAD, and BMOUNT.

All movement, except boundary crossing (BOUNDX), is controlled by the decision code, and the following are called by subroutine DECIDE: BMOUNT, BDMONT, MOVE, CHGVRT. In DECIDE command units also call artillery (CLARTY) and helicopter (CLHCPR).

The following list gives the codes that can be generated by the various routines.

Code	Generating routines
0	ASSESS, BMOUNT, BOUNDX, CLARTY, CLHCPR, DECIDE, FIRING, MOVE, TGTSEL
8	MOVE
16	BDMONT
25-28	CHGVRT, SURV
32	CHGVRT
48	BMOUNT

Code	Generating routines
65-68	DECIDE, FIRING, IMPACT, TGTACQ
73-76	ASSESS, CLARTY, DESTGT, TGTSEL
97-100	FIRING
113-116	IMPACT
193-196	FIRING, IMPACT
320	ASSESS, BOUNDX CHANGE, CLHCPR, NEWMIS
328	ASSESS, CHANGE

EXEC2

Purpose: This routine is the main program for Overlay (2,0), which contains most of the battle model. It checks all master clocks and selects the unit with lowest clock for processing. The event code with this clock determines the routing and calling of subroutines BOUNDX, DECIDE, TACTIC, ASSESS, COMMO, FIRING, IMPACT, RESPNS, SURV, and TGTSEL. Other subroutines called are NEUT, NEWMIS and logical functions STOP1, STOP2, and STOP3.

Arguments: Labeled common MAIN, RUN, CNTRL, CLOCK, TREAT

Called by: Overlay (0,0) (EXECJK)

The number of the unit being processed is stored in MUNIT if it is a weapon unit and in IFHQ if it is a headquarters or command unit. KSAVE is set equal to the neutralization clock, ICLKN.

If all units on a side are dead, the history message is stored, and control returns to Overlay (0,0) EXECJK.

If live units exist on each side, the lowest master clock of all units on both sides, along with its code, is stored in KSAVE (do 50). The master clocks of all headquarters are checked (DO 60) and the lowest, if lower than KSAVE, is entered in KSAVE along with its code. The unit and side are now in MUNIT and MSIDE. If no master clock was smaller than the neutralization clock, MUNIT remained zero. If a weapons unit is to be processed, IFHQ remains zero.

If a headquarters unit is to be processed, its buddy unit number is entered into MUNIT (statement 65). The time and code in KSAVE is entered into KTIME and KCODE.

If MUNIT is zero, control goes to statement 100. Logical Function STOP1 is checked to determine if battle should be terminated due to proximity of forces. If TRUE, the history message is written by the function, and control returns to Overlay (0,0) EXECJK.

The DO 101 loop processes all live units, except those that are mounted, through the neutralization subroutine.

If a command unit is to be processed, the number of command units on that side is stored in ICNBR at statement 150.

The current code, time, unit, and side are compared with those of the last previous processing at statement 160. If there were no changes in any of these, the program is in a loop, and the "loop stopper" is entered. Exit is then made to Overlay (0,0) EXECJK. If this event is not identical to the one immediately preceding, the code, time, unit, and side are saved for the next time through the DO loop.

If an air unit is to be processed, LLAC is set TRUE. The opposite side is entered in IOPP and the number of enemy units in ITNBR. The coordinates and altitude of the unit to be processed are entered into IXS, IYS, and IZS. MWP is set to zero. Bits 1-3 of KCODE are extracted into MSENS, to give the type of sensor if the code is surveillance. The middle digit of KCODE is extracted into KCODE1 and incremented by one. This octal digit determines the routing at statement 170 if a unit, rather than a weapon, is the basis of processing, the unit (KCODE between 0 and 40). A KCODE between 320 and 328 routes the processing to TACTIC. Bits 1-3 of KCODE, which indicate whether the weapon is weapon 1, 2, 3, or 4, is entered in MWP. KCODE1 also determines the routing at statement 650 for weapon group codes. Control goes to statement 160 if the weapon code is end loading.

The routings at statement 170 and 650, generally call the subroutines indicated by the code, set JSWICH to control the routing at statement 800, and send control to 800. Since most routings are straightforward, and commented in the program and the accompanying flow charts, only a few will be discussed in this section.

If the code is "End Dismount", control goes to statement 825. The dismounting bit is turned off in JATRIB, MWG is extracted from the order in JCNTRL, and control goes to statement 610. If MWG equals two, indicating that the unit dismounted as a result of orders rather than as a result of the carrier being killed, NEWMIS is called and control goes to 800.

If the code is "Change Altitude," control goes to statement 640. NWG is extracted from the order in JCNTRL, and if equal to three, indicating the altitude change was under orders and not due to fire received, NEWMIS is called and control goes to 800.

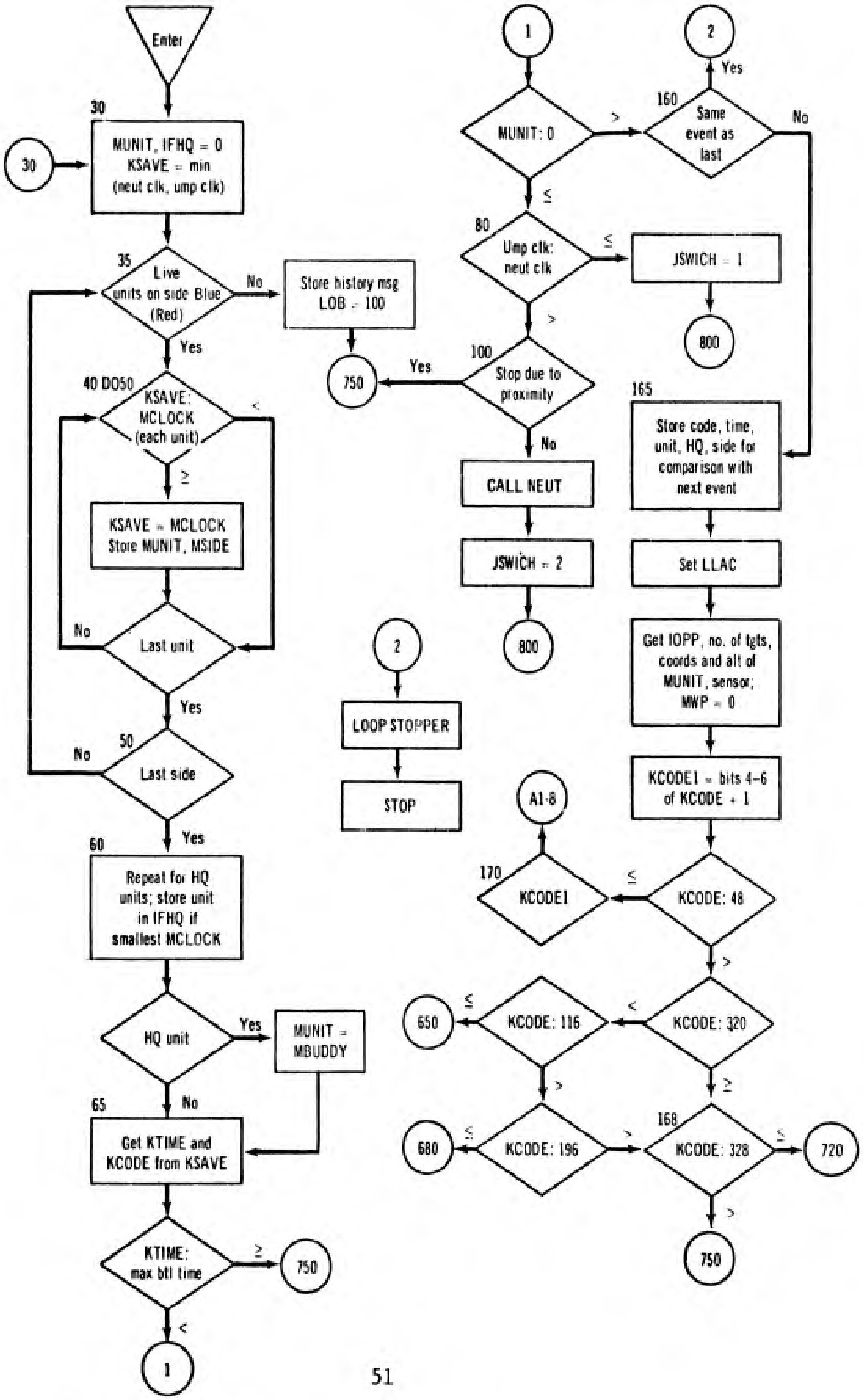
If the code was "End Loading," control goes to 680where LLCLK is set equal to lower infinity and LLCDE to zero (decision). The loading clock time is entered into LOADCK, JSWICH set to thirteen and control goes to 800. At 800 JSWICH sends control to statement 870. The weapon event time is extracted from JCNTRL and entered into LEVENT; LLCLK and LLCDE are packed into JCNTRL. The weapons event and loading clocks, as they existed when this routine was entered, are compared. If the event is greater, control goes to statement 830, LOWCLK is called and control goes statement 30 to select the next unit. If the unit being processed is artillery this comparison is bypassed. If the event clock is not greater than the loading clock, or if the unit is artillery, control goes to statement 880. The aim bit is checked in JATRIB, if it is not "On," control goes to 830, if it is "On" to statement 670. Subroutine FIRING is called. If the unit is an aircraft RESPNS is called first. This sequence of coding is to postpone a non-artillery unit from firing a weapon until the event clock is not greater than the loading clock, since such a firing would destroy the weapon's event clock. Aircraft are checked to determine if they should abort before firing.

At statement 650 the routings are for weapon's code other than end loading; only two need be discussed here. After subroutine IMPACT is called, logical functions STOP2 and STOP3 are checked to determine if the battle should be terminated due to personnel or vehicle casualties. If the code is "End Aiming," control goes to statement 855. The aim bit in JATRIB is turned "On," the loading clock is loaded into LLCLK, and control goes to statement 660. If LLCLK is equal to lower infinity, control goes to 670 to call FIRING; if not equal to lower infinity, JSWICH is set equal to twelve. If LLCLK is not equal to upper infinity and JSWICH is equal to eleven, control goes to 800. For JSWICH equal to twelve, control goes to 875 where LWCLK is set equal to upper infinity and LWCDE equal to zero. At statement 866 these are packed in the weapon's event clock and code in

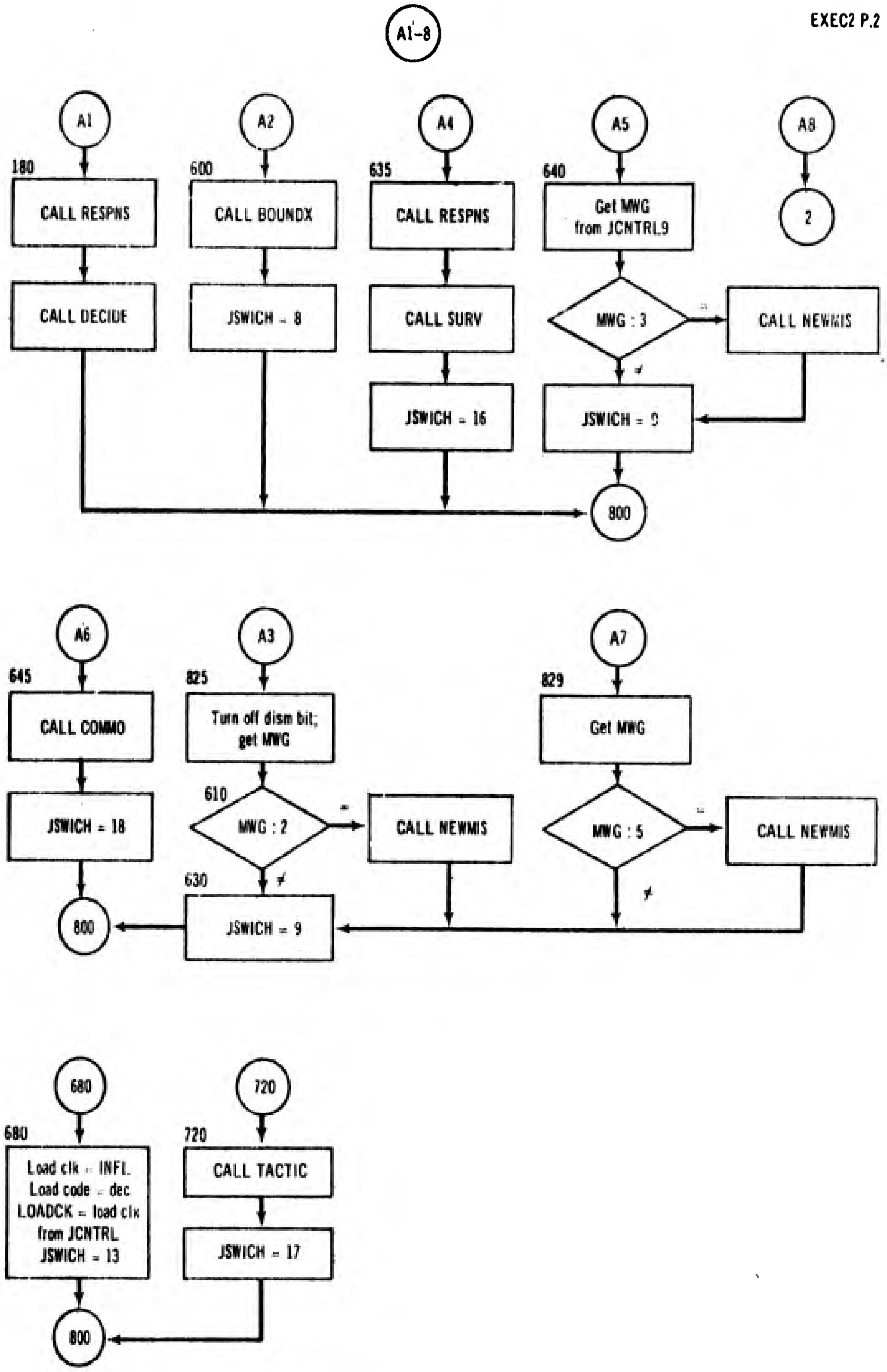
JCNTRL, and control goes to 830. For JSWICH equal to eleven control goes to statement 860. LWCLK is set to loading clock, LLCLK, plus one, and LWCDE to end loading. Control then passes to 866.

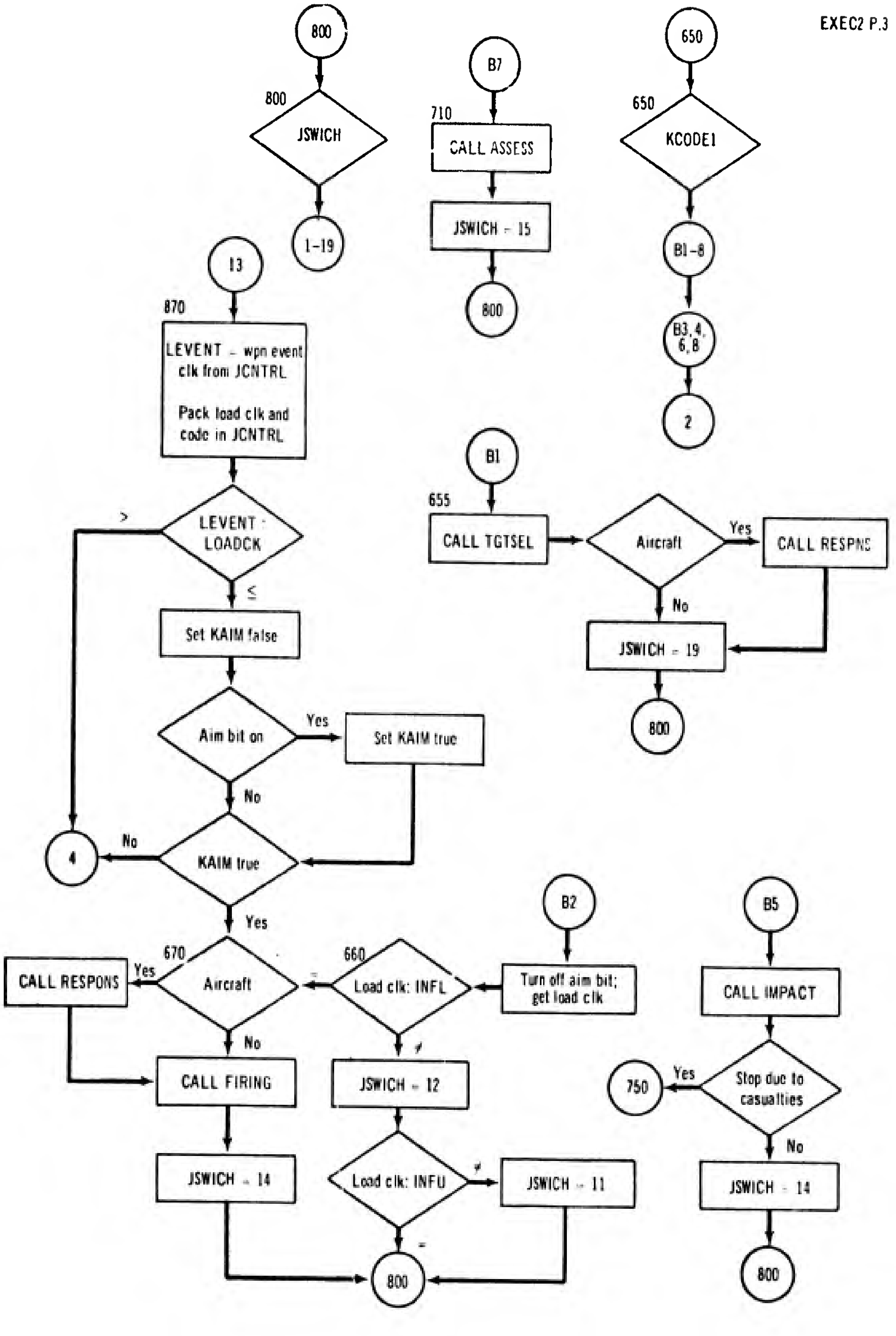
After the various subroutine calls, control goes to statement 800. Routings from here are controlled by the JSWICH setting discussed above. Almost all go to 830 to call LOWCLK for the unit being processed and then to statement 30 to pick up the next unit. Some exceptions have been discussed previously, others are described below.

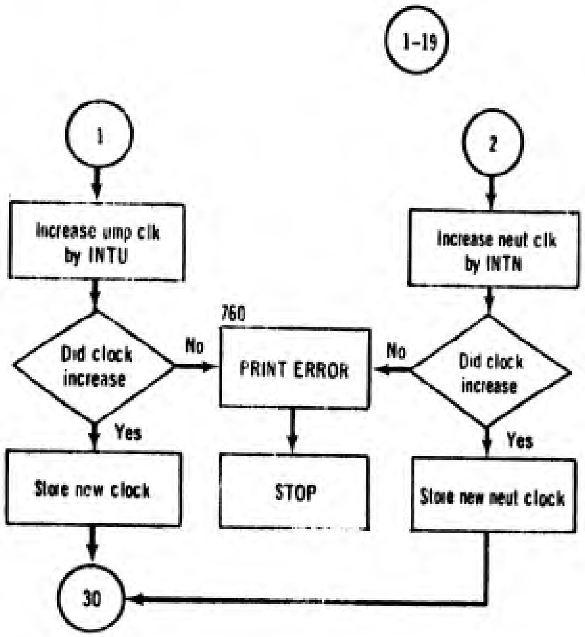
The call to NEUT sends control to 820 and 830. The neutralization cycle time is added to the current neutralization clock, ICLKN, and control goes to 30. JSWICH equal to five is set in DECIDE for change altitude. Control goes to statement 840 to turn off the move bit in JATRIB, control is then transferred to 830. For codes "End Dismount" and "End Mount," control goes to 850 to set the control clock to current time and control code to decision.

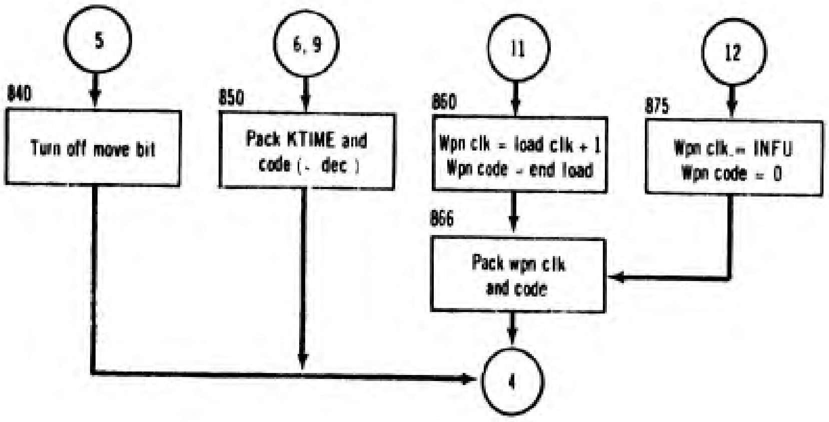

Enter
30
30
MUNIT, IFHQ = 0
KSAVE = min
(neut clk, ump clk)
35
Live units on side Blue (Red)
No
Store history msg
LOB = 100
750
Yes
40 DO50
KSAVE: MCLOCK (each unit)
<
≥
KSAVE = MCLOCK
Store MUNIT, MSIDE
No
Last unit
Yes
50
No
Last side
Yes
60
Repeat for HQ units; store unit in IFHQ if smallest MCLOCK
HQ unit
Yes
MUNIT = MBUDDY
No
65
Get KTIME and KCODE from KSAVE
KTIME: max btl time
≥
750
<
1
1
MUNIT: 0
>
≤
80
Ump clk: neut clk
≤
JSWICH = 1
800
>
100
Stop due to proximity
Yes
750
No
CALL NEUT
JSWICH = 2
800
2
LOOP STOPPER
STOP
2
Yes
160
Same event as last
No
165
Store code, time, unit, HQ, side for comparison with next event
Set LLAC
Get IOPP, no. of tgts, coords and alt of MUNIT, sensor; MWP = 0
KCODE1 = bits 4-6 of KCODE + 1
A1-8
170
KCODE1
≤
KCODE: 48
>
KCODE: 320
<
KCODE: 116
≤
650
>
KCODE: 196
≤
680
>
≥
168
KCODE: 328
≤
720
>
750

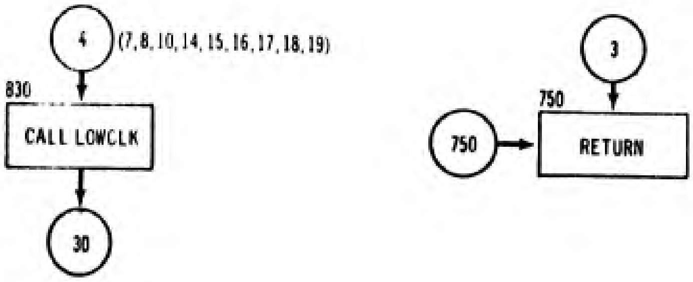
EXEC2 P.2


A1-8
A1
180
CALL RESPNS
CALL DECIDE
A2
600
CALL BOUNDX
JSWICH = 8
A4
635
CALL RESPNS
CALL SURV
JSWICH = 16
A5
640
Get MWG from JCNTRL9
MWG : 3
=
≠
CALL NEWMIS
JSWICH = 9
A8
2
800
A6
645
CALL COMMO
JSWICH = 18
800
A3
825
Turn off dism bit; get MWG
610
MWG : 2
=
≠
CALL NEWMIS
630
JSWICH = 9
A7
829
Get MWG
MWG : 5
=
≠
CALL NEWMIS
680
680
Load clk = INFL
Load code = dec
LOADCK = load clk from JCNTRL
JSWICH = 13
800
720
720
CALL TACTIC
JSWICH = 17


EXEC2 P.3
800
800
JSWICH
1-19
B7
710
CALL ASSESS
JSWICH = 15
800
650
650
KCODE1
B1-8
B3, 4, 6, 8
2
13
870
LEVENT = wpn event clk from JCNTRL
Pack load clk and code in JCNTRL
>
LEVENT : LOADCK
≤
Set KAIM false
Aim bit on
Yes
Set KAIM true
No
4
No
KAIM true
Yes
B1
655
CALL TGTSEL
Aircraft
Yes
CALL RESPNS
No
JSWICH = 19
800
B2
Turn off aim bit; get load clk
B5
CALL IMPACT
670
Yes
CALL RESPONS
Aircraft
No
CALL FIRING
JSWICH = 14
660
=
Load clk: INFL
≠
JSWICH = 12
Load clk: INFU
≠
JSWICH = 11
=
800
750
Yes
Stop due to casualties
No
JSWICH = 14
800


1-19
1
2
Increase ump clk by INTU
Increase neut clk by INTN
760
Did clock increase
No
PRINT ERROR
No
Did clock increase
Yes
Yes
Store new clock
STOP
Store new neut clock
30


5
6, 9
11
12
840
Turn off move bit
850
Pack KTIME and code (- dec)
860
Wpn clk = load clk + 1
Wpn code - end load
875
Wpn clk = INFU
Wpn code = 0
866
Pack wpn clk and code
4


(7, 8, 10, 14, 15, 16, 17, 18, 19)
CALL LOWCLK
RETURN

ADJUST

Purpose: To adjust the movement times for aircraft when the move is diagonal. Also adjustment is made if the altitude change exceeds the largest steep climb threshold.

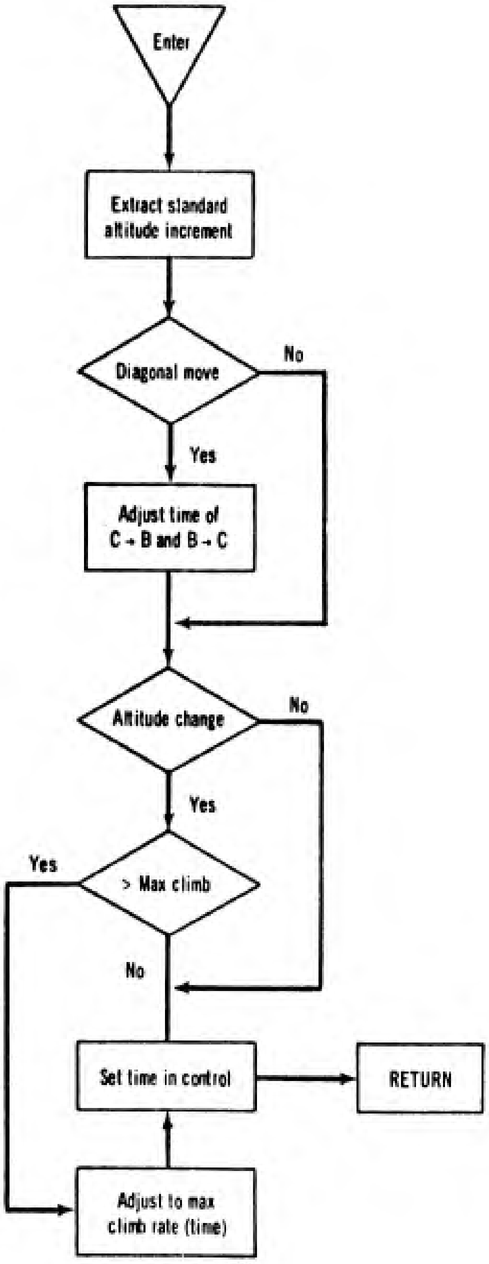
Arguments: ITCB (time center to boundary), ITBC (boundary to center), LAA (the altitude change), and LCM (the mobility class of the unit being processed). Labeled common MAIN.

Called by: MOVAIR

The standard altitude increment is entered in LDELAS. If the move is diagonal, ITCB and ITBC are multiplied by the square root of two. If there is no altitude change, LAA equals zero, or if the altitude change is not greater than the steep climb threshold, ITCB is packed in JCNTRL, and control returns to calling routine.

If the altitude change is greater than the steep climb threshold control goes to statement 70. The vertical climb time for this mobility class, INCTUP, is extracted from JAMOB. The time boundary to center, ITBC, is computed by adding the climb time multiplied by the difference between the altitude change and the steep climb threshold divided by the square of the standard altitude increment. ITCB is then set equal to ITBC, and control returns to the calling routine.

ADJUST


Enter
Extract standard altitude increment
Diagonal move
No
Yes
Adjust time of C → B and B → C
Altitude change
No
Yes
> Max climb
Yes
No
Set time in control
RETURN
Adjust to max climb rate (time)

ASSESS

Purpose: Sets clocks and codes to fire next volley or to call NEWMIS if no more volleys are to be fired under current order. Sets code for call to TACTIC if unit is out of ammo and has escape orders. If the firer was dead before impact, the weapon event clock is not set to INFU until assessment. The subroutine is called at assessment time after impact.

Arguments: Labeled common MAIN, CNTRL.

Called by: EXEC2.

LWCDE (the weapons code) is set to zero (decision). LSDEAD (firing unit dead) and LTAREA (area target) are set TRUE or FALSE. If both are TRUE, control goes to statement 100. If both are NOT TRUE, ammo type one and two on hand are stored in LAMW1 and LAMW2 and total ammo in LAMWA. LFMOVE (unit moving or not) is set TRUE or FALSE. Remaining volleys to be fired for the current order is entered in LSMCHK, kind of fire into MWF1, and LFR2 is set TRUE or FALSE if the firing unit is partially neutralized or not. The DO 2 loop stores the weapons event clocks in array LWCLKA. If the target is an area target, control goes to statement 30, if not the target number is entered in ITNO.

If the firer is dead, LSDEAD TRUE, control goes to statement 100. If the firer is not dead, control passes to statement 31. Total ammo on hand (LAMWA) is checked. If there is no ammunition on hand, control goes to statement 80. If firer is moving, LFMOVE TRUE, control goes to statement 70. The number of volleys remaining to be fired on this order is checked at statement 50. If there are volleys remaining to be fired, control goes to statement 210.

If the firer is not dead, not moving, has ammo on hand, and no volleys remain to be fired on the current order, and is not artillery, control goes to statement 171. The tactic clock (LTCLK) is set to current time, and the code (LTCDE) is set to "tactic." If the units control code is "decision" the control clock is set to the tactic clock plus one and packed into JCNTRL. The weapon event clock is set to lower infinity and control goes to statement 200.

At statement 70 (firer moving, ammo on hand), if the firer can fire while moving, control goes to statement 40. If the unit cannot fire while moving and is partially neutralized by direct fire, control also goes to statement 40. In all other instances the weapon event clock (LWCLK) is set to lower infinity, and control goes to statement 240.

At statement 80 (the firing weapon is out of ammo), the event clocks of all weapons in the unit are checked against upper infinity. If all are equal to INFU, LFIRE (unit unable to fire) is set TRUE at statement 100. In either case the target description work, LJT, is set to zero and, this weapon event clock, LWCLK, to upper infinity.

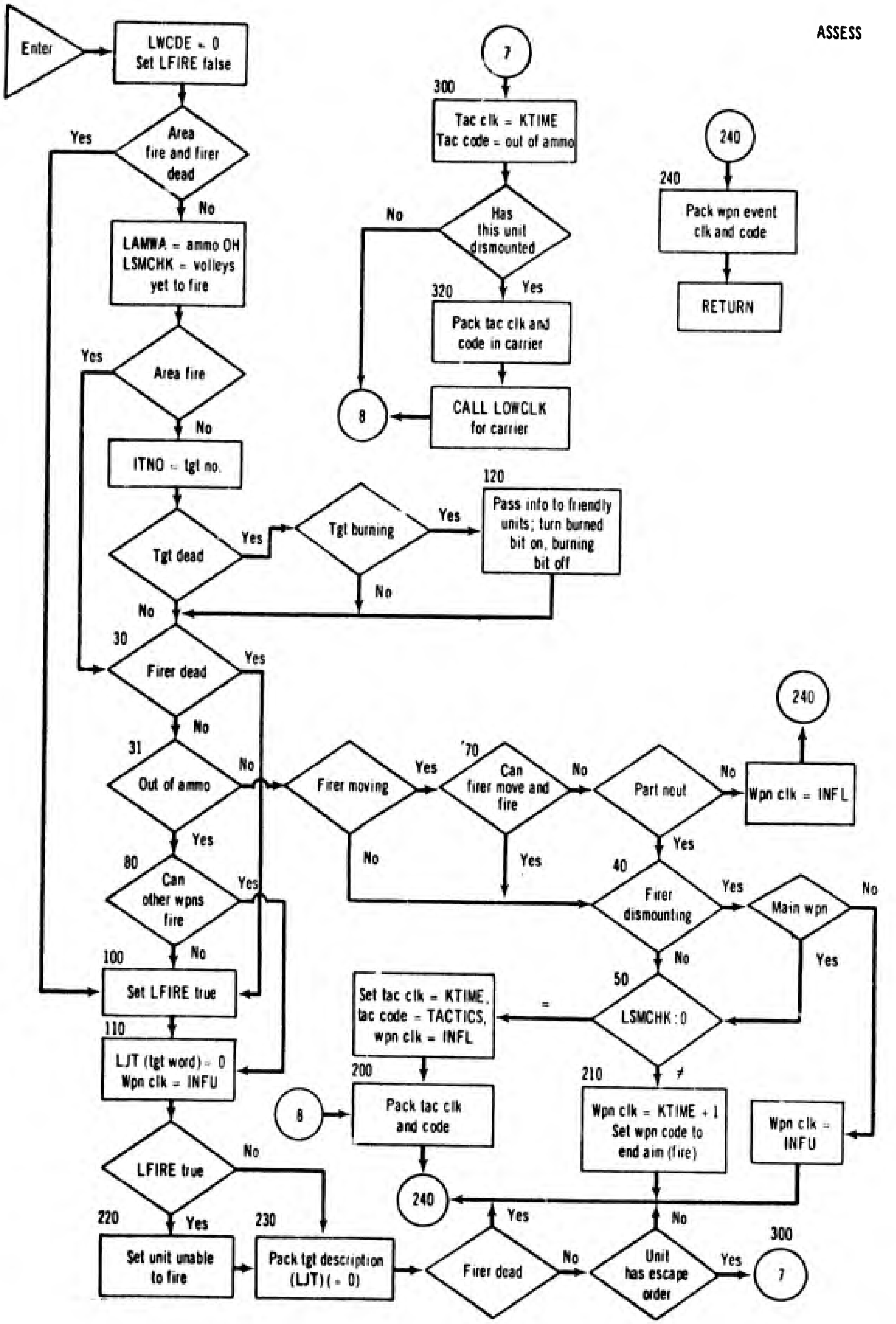
At statement 120 (the target is dead), this information is passed to all friendly units which are not dead and in line of sight to the dead target (DO 150). Control then goes to statement 30.

At statement 200, the tactic clock and code are packed in JCNTRL, and control goes to statement 240.

At statement 210 (the weapon can fire and there are remaining volleys to be fired), the weapon event clock and code are set to current time plus one and "end aiming" (firing). Control then goes to statement 240.

If the unit is unable to fire (statement 220, from statement 80), the appropriate bit is turned ON in JATRIB; control then passes to 230. If the unit is able to fire any of its other weapons, control will go to 230. The target description, LJT, now zero, for the firing weapon is packed in JUCHAR.

At this point (before statement 300), the unit is out of ammo. If it does not have escape orders control goes to statement 240. If the unit has escape orders, the tactic clock and code are set to current time and "out of ammo," and control goes to statement 200. If the unit being processed is a carrier which has dismounted a passenger unit, the tactic clock and code are packed in JCNTRL of the dismounted unit, and LOWCLK is called before going to statement 200.

ASSESS
Enter
LWCDE = 0
Set LFIRE false
Area fire and firer dead
Yes
No
LAMWA = ammo OH
LSMCHK = volleys yet to fire
Area fire
Yes
No
ITNO = tgt no.
Tgt dead
Yes
No
Tgt burning
Yes
No
120
Pass info to friendly units; turn burned bit on, burning bit off
30
Firer dead
Yes
No
31
Out of ammo
No
Yes
80
Can other wpns fire
Yes
No
100
Set LFIRE true
110
LJT (tgt word) = 0
Wpn clk = INFU
LFIRE true
No
Yes
220
Set unit unable to fire
230
Pack tgt description (LJT) (= 0)
Firer dead
Yes
No
Unit has escape order
Yes
No
300
7
Firer moving
Yes
No
70
Can firer move and fire
No
Yes
Part nout
No
Yes
Wpn clk = INFL
240
40
Firer dismounting
Yes
No
Main wpn
No
Yes
50
LSMCHK : 0
=
≠
Set tac clk = KTIME, tac code = TACTICS, wpn clk = INFL
200
Pack tac clk and code
8
210
Wpn clk = KTIME + 1
Set wpn code to end aim (fire)
Wpn clk = INFU
240
7
300
Tac clk = KTIME
Tac code = out of ammo
Has this unit dismounted
No
Yes
320
Pack tac clk and code in carrier
CALL LOWCLK for carrier
8
240
240
Pack wpn event clk and code
RETURN

BDMONT

Purpose:	This subroutine dismounts a passenger unit from its carrier, passes intelligence of the carrier to the dismounting unit, gets cover and concealment for the unit, and transfers personnel and weapons to the dismounted unit. Kills the carrier unit if it was called by IMPACT and has no vehicles remaining. Sets the clocks to take further action after dismounting ends.
Arguments:	MU, MS (the carrier unit and side) and logical variable IMPAC (TRUE if called by IMPACT). Labeled common MAIN, CNTRL, CLOCK, TERRAN, HSTDAT
Called by:	IMPACT, if carrier was hit and killed or if troop carrying vehicles surviving do not have the capacity to carry the surviving members of the passenger unit; RESPNS, if the carrier is an open vehicle and is pinned down; DECIDE if executing a dismount order.

If called by IMPACT, MUNIT and MSIDE are saved (they would be the firing unit) and MU and MS stored in MUNIT and MSIDE.

If a unit is erroneously designated a troop carrier, control goes to statement 150. At statement 5 the dismounting unit number is stored in LDMU. The carrier's intelligence is given to the dismounting unit (DO 15). The location of the carrier is passed on to LDMU. LSCHEK is called for LDMU. The element size class of the dismounting unit is stored in JRAD. Cover and concealment of the square is obtained by a call to TERRA. Apparent radius for detection, LCON1, apparent radius for hit, LCOV1, and net cover index, LCOV2, are extracted from JCNVRT (statements 20, 25, 30, 35).

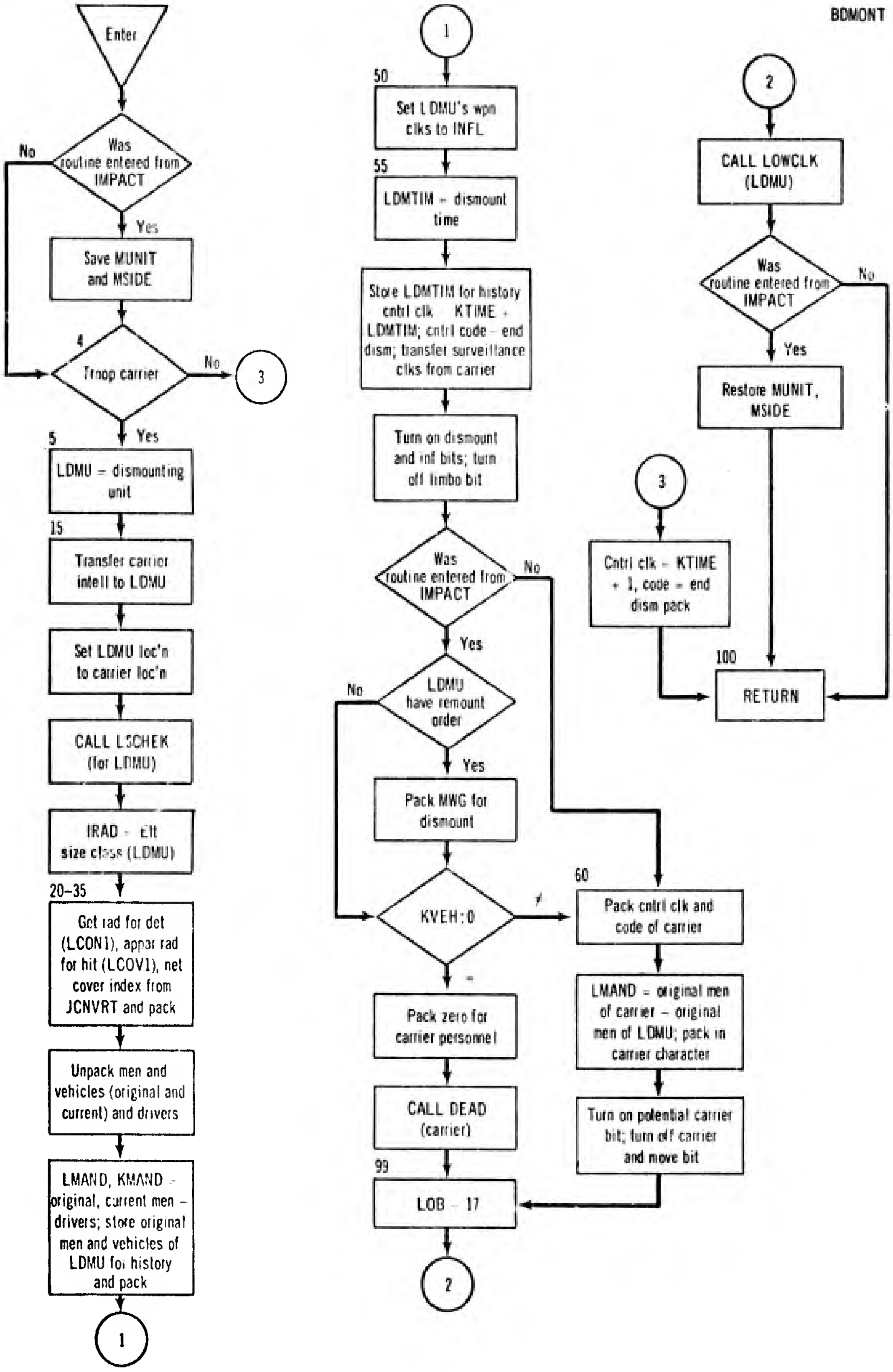
Original and current number of men and vehicles and number of drivers of the carrier are extracted from JUCHAR (this includes men belonging to the passenger unit). The number of drivers is subtracted from the original and current number of men to obtain the original and current men of the passenger unit, and are then packed in JUCHAR of LDMU. The weapon event clocks of weapons assigned to the dismounting unit are set to lower infinity (statements 40, 50). After getting the mobility class of the carrier, the dismount time is stored in LDMTIM (at statement 55). The control clock of LDMU are set to current time plus dismount time and code to "End Dismount." Bits are set in JATRIB to indicate the unit dismounting, not dead, infanty, and not mounted.

If dismounting was not caused by killing of the carrier (called from IMPACT) control goes to statement 60. If called from IMPACT, MWG of the dismounting unit is checked to see if the unit is executing a remount order; if it is, the unit is given a dismount code. If the carrier has vehicles remaining control goes to statement 60. If the carrier has no vehicles subroutine DEAD is called and control goes to statement 99.

At statement 60, if the subroutine was called by RESPNS or DECIDE, the control clock of the carrier is set to current time plus dismount time and the code to "End Dismount." The number of men and drivers who will remain with the carrier is stored in JUCHAR. Bits are set in JATRIB to indicate the carrier does not have a passenger unit, is not moving, and can mount a passenger unit.

At statement 99 the history message is stored. Then LOWCLK is called for the dismounted unit. MUNIT and MSIDE are restored if call was from IMPACT and control is returned to the calling routine.

At statement 150, if a unit has a dismount order and is not a carrier, the control clock and code are set to current time plus one and to "End Dismount", and control is returned to the calling routine.


BDMONT
Enter
Was routine entered from IMPACT
No
Yes
Save MUNIT and MSIDE
4
Troop carrier
No
3
5
Yes
LDMU = dismounting unit
15
Transfer carrier intell to LDMU
Set LDMU loc'n to carrier loc'n
CALL LSCHEK (for LDMU)
IRAD = Elt size class (LDMU)
20–35
Get rad for det (LCON1), appar rad for hit (LCOV1), net cover index from JCNVRT and pack
Unpack men and vehicles (original and current) and drivers
LMAND, KMAND = original, current men – drivers; store original men and vehicles of LDMU for history and pack
1
1
50
Set LDMU's wpn clks to INFL
55
LDMTIM = dismount time
Store LDMTIM for history cntrl clk = KTIME + LDMTIM; cntrl code = end dism; transfer surveillance clks from carrier
Turn on dismount and inf bits; turn off limbo bit
Was routine entered from IMPACT
No
Yes
LDMU have remount order
No
Yes
Pack MWG for dismount
KVEH:0
≠
=
60
Pack cntrl clk and code of carrier
LMAND = original men of carrier – original men of LDMU; pack in carrier character
Turn on potential carrier bit; turn off carrier and move bit
Pack zero for carrier personnel
CALL DEAD (carrier)
99
LOB = 17
2
2
CALL LOWCLK (LDMU)
Was routine entered from IMPACT
No
Yes
Restore MUNIT, MSIDE
3
Cntrl clk = KTIME + 1, code = end dism pack
100
RETURN

BMOUNT

Purpose: This routine mounts the infantry units on carriers if both have remount orders, are alive, and in the same square. If both are alive and have remount orders but are not in the same square, or if the infantry unit is processed first, the control clock of the unit being processed is set to reenter the routine at a specified later time. The dismounted unit's intelligence, current and original men are combined with that of the carrier.

Arguments: Labeled common MAIN, CLOCK, CNTRL, HSTDAT.

Called by: DECIDE.

The unit being processed is checked to determine if: it is not a troop carrier that can remount a passenger unit; it is a passenger unit to be remounted; or it is neither.

If the unit being processed is not a troop carrier that can remount a passenger unit, control goes to statement 200.

If the unit (numbered n) being processed is a unit to remount, the next lower numbered unit (numbered n-1) is checked to determine if it is the potential carrier unit; if it is not, control returns to the calling routine. This will later force EXEC2 into the "loop stopper." If 200 shows the unit to remount is being processed, check is made if the carrier is dead. If it is (statement 230) the control clock and code of the unit to remount are set to current time plus one and end mounting. This code is to insure proper routing in EXEC2. LOWCLK is called and control is returned to calling routine. If the carrier is not dead, control clock of the unit being processed is set to current time plus dismount (remount) time, for ground or air units as appropriate. This sets up an attempt to remount again.

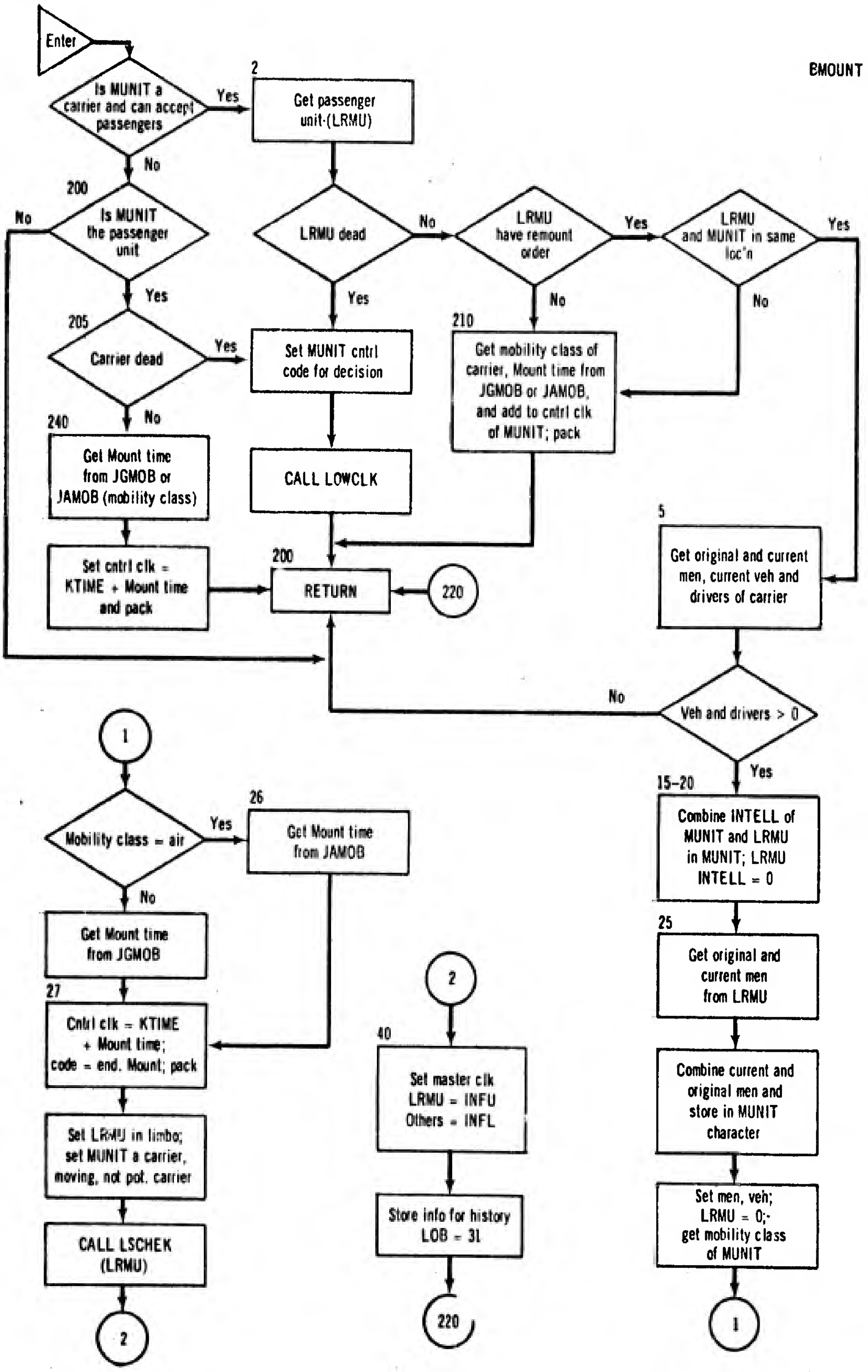
If the unit being processed is a carrier which can remount a passenger unit control goes to statement 2 and the number of the unit to remount is stored in LRMU. If LRMU is dead control goes to statement 230.

If the unit to remount does not have a remount order, control goes to statement 210 and the control clock of the carrier unit is set to current time plus remount time for ground or air as appropriate, and control is returned to the calling routine. If the unit has a remount order but is not in the same square as the carrier, control also goes to 210.

If both carrier and unit to remount are in the same square, the original and current men, drivers and vehicles of the carrier are extracted from JUCHAR. The intelligence of both units are combined into the intelligence array of the carrier and intelligence of the remounting unit set to zero (DO 20). The original and current men of both units are combined in that of the carrier, and that of the remounting unit set to zero. The remount time, ground or air, is stored in LDMTIM. The control clock and code of the carrier are set to current time plus remount time and end remounting. Bits in JATRIB are set to show passenger unit in limbo, the carrier has a passenger unit and cannot accept a passenger unit and is moving.

LSCHEK is called for the remounted unit. For the unit in limbo all line of sight will be lost. All clocks of the mounted unit are set to lower infinity and its master clock to upper infinity (DO 40).

The history message is then stored and control returned to the calling routine.


EMOUNT
Enter
Is MUNIT a carrier and can accept passengers
Yes
2
Get passenger unit-(LRMU)
No
200
Is MUNIT the passenger unit
No
LRMU dead
No
LRMU have remount order
Yes
LRMU and MUNIT in same loc'n
Yes
Yes
Yes
No
No
205
Carrier dead
Yes
Set MUNIT cntrl code for decision
210
Get mobility class of carrier, Mount time from JGMOB or JAMOB, and add to cntrl clk of MUNIT; pack
No
240
Get Mount time from JGMOB or JAMOB (mobility class)
CALL LOWCLK
5
Get original and current men, current veh and drivers of carrier
Set cntrl clk = KTIME + Mount time and pack
200
RETURN
220
No
Veh and drivers > 0
Yes
1
15–20
Combine INTELL of MUNIT and LRMU in MUNIT; LRMU INTELL = 0
26
Mobility class = air
Yes
Get Mount time from JAMOB
No
Get Mount time from JGMOB
25
Get original and current men from LRMU
2
27
Cntrl clk = KTIME + Mount time; code = end. Mount; pack
40
Combine current and original men and store in MUNIT character
Set master clk LRMU = INFU Others = INFL
Set LRMU in limbo; set MUNIT a carrier, moving, not pot. carrier
Set men, veh; LRMU = 0; get mobility class of MUNIT
Store info for history LOB = 31
CALL LSCHEK (LRMU)
2
220
1

BOUNDX

Purpose:	To move the unit being processed from the boundary to the center of the new square. Gives the unit a "stay" order if it was on an escape order and is now on its objective.
Arguments:	Labeled common MAIN, CNTRL, HSTDAT
Called by:	EXEC2.

After unpacking, the new coordinates are stored in IXS, IYS, and the current (soon to be old) into IXNEW and IYNEW. If the unit being processed is infantry, KTRIG is set depending on suppression state of the unit; pinned down, partially suppressed by direct fire, or not suppressed. KONCOV is then called to get cover and concealment of the new square (statement 120).

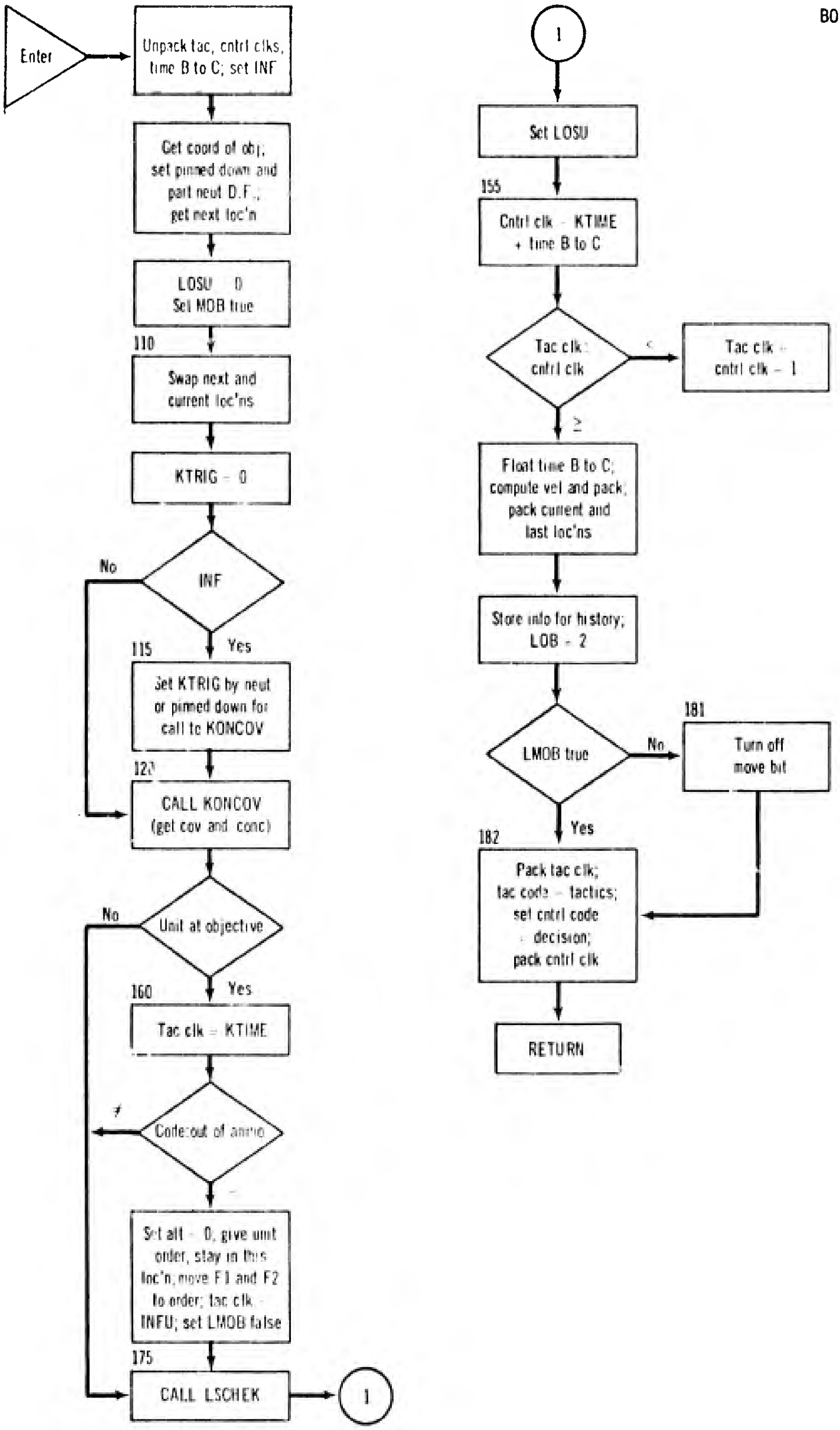
If the unit is at its objective, control goes to statement 160, and the tactic clock is set to current time. If the unit reached this objective while executing an escape order, it is given a stay order, retaining its kind and priority of fire, its tactic clock is set to upper infinity, and, if an aircraft, its altitude is set to zero and fire received set to zero. LMOB, is set FALSE, indicating the unit is unable to move. Control then passes to statement 170.

If the unit was not executing an escape order or is not on its objective, control goes to statement 170. LSCHEK is called and line of sight word stored in LOSU.

At statement 155, LCCLK is set to current time plus ITBC, time required to move from boundary to center of the square. If the tactic clock, LTCLK, is less than the control clock, LCCLK, it is reset to control clock minus one. The time, boundary to center, is floated and the velocity computed. Current and last locations of the unit are packed in JCNTRL.

If LMOB is FALSE, the "able to move" bit is turned OFF in JATRIB. The tactics clock and control clock are packed in JCNTRL. The tactic code is set to "tactic" and the control code to "decision." Control returns to calling routine.

BOUNDX


Enter
Unpack tac, cntrl clks, time B to C; set INF
Get coord of obj; set pinned down and part neut D.F.; get next loc'n
LOSU = 0
Set MOB true
110
Swap next and current loc'ns
KTRIG = 0
INF
No
115
Yes
Set KTRIG by neut or pinned down for call to KONCOV
120
CALL KONCOV (get cov and conc)
Unit at objective
No
160
Yes
Tac clk = KTIME
Code:out of ammo
≠
=
Set alt = 0, give unit order, stay in this loc'n; move F1 and F2 to order; tac clk = INFU; set LMOB false
175
CALL LSCHEK
1
1
Set LOSU
155
Cntrl clk = KTIME + time B to C
Tac clk : cntrl clk
<
Tac clk = cntrl clk − 1
≥
Float time B to C; compute vel and pack; pack current and last loc'ns
Store info for history; LOB = 2
LMOB true
No
181
Turn off move bit
Yes
182
Pack tac clk; tac code = tactics; set cntrl code = decision; pack cntrl clk
RETURN

CHGVRT (Change Altitude)

Purpose: To compute the time required to change altitude. The control code is set to "change altitude," which will cause a call to NEWMIS in EXEC2 after the time required for altitude change. The surveillance clock is set so that a call to SURV takes place after the time to change altitude plus scan time.

Arguments: Labeled common MAIN, TERRAN, HSTDAT.

Called by: DECIDE, RESPNS

MWI (moving order altitude) is extracted from JCNTRL; LCM (mobility class) from JUCHAR; LDELAS (the standard altitude increment) from JAMOB; and IZS (the current altitude) from JCNTRL.

If the change altitude is to treetop, control goes to statement 1. Subroutine TERRA is called to get vegetation height, LVEG. IALT is set equal to LVEG plus 5 feet. Vertical descent time, INCTON, is extracted from JAMOB. The altitude difference IZS-IALT is computed. This difference is divided by the standard altitude increment and the quotient multiplied by INCTON to get the time of descent, LTIME. The control clock and code are set to current time plus LTIME and "change altitude," IALT to the new altitude, and packed into JCNTRL. LSCHEK is called to get new lines of sight. The history message is stored, and control returns to calling routine.

If the change altitude is to land, control goes to statement 2. Tactic time and code are set to current time plus one and "change altitude," altitude is changed to zero, and packed into JCNTRL. The history message is stored, and control returns to calling routine. Line-of-sight is checked in NEWMIS for change altitude to land.

If the change altitude is not treetop or land, the number of the target to which LOS is to be gained is extracted from JUCHAR2 and entered in ITNO. It is replaced in the regular place in JUCHAR3 in case it was lost during a previous altitude change. The target location is extracted from JCNTRL and inserted in the target word of JUCHAR.

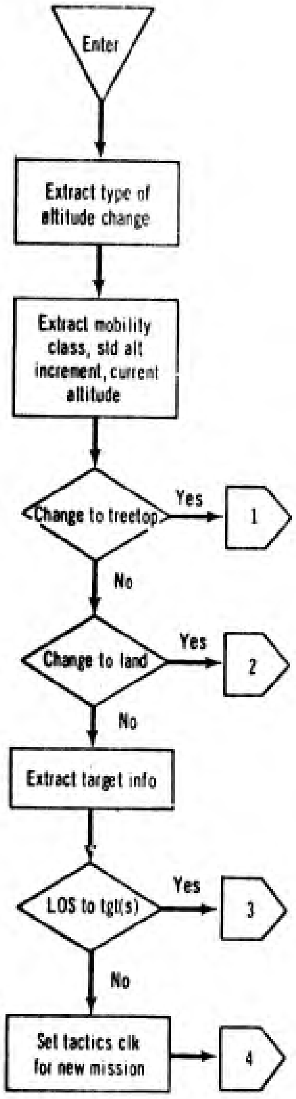
LS2TG is called to get necessary altitude for line of sight. If none exists at any altitude, control clock and code in JCNTRL are set to current time and "change altitude," the history message is stored, and control returns to calling routine.

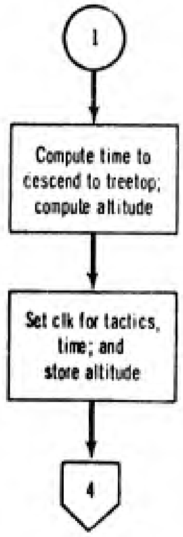
If a change of altitude is necessary to gain line of sight, it is computed and stored in IALT and the new altitude stored in IZS. The altitude change is also stored in KAD and the new altitude packed in JCNTRL.

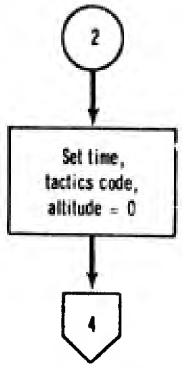
The vertical climb time per altitude increment is extracted from JAMOB and entered in INTCUP. The climb time, LTIME, is computed by multiplying the quotient of KAD divided by the standard altitude increment, LDELAS, by INTCUP. LTIME is then incremented by the current time.

At statement 400, LTIME and change altitude are packed into the control clock and code of JCNTRL. The units sensor class and type are stored in LSC and LST. LTIME is then incremented by the scan time of this sensor from JDTECT. LTIME and "surveillance" are stored in time and code of sensor type number one in JCNTRL. The history message is stored, and control returns to calling routine.

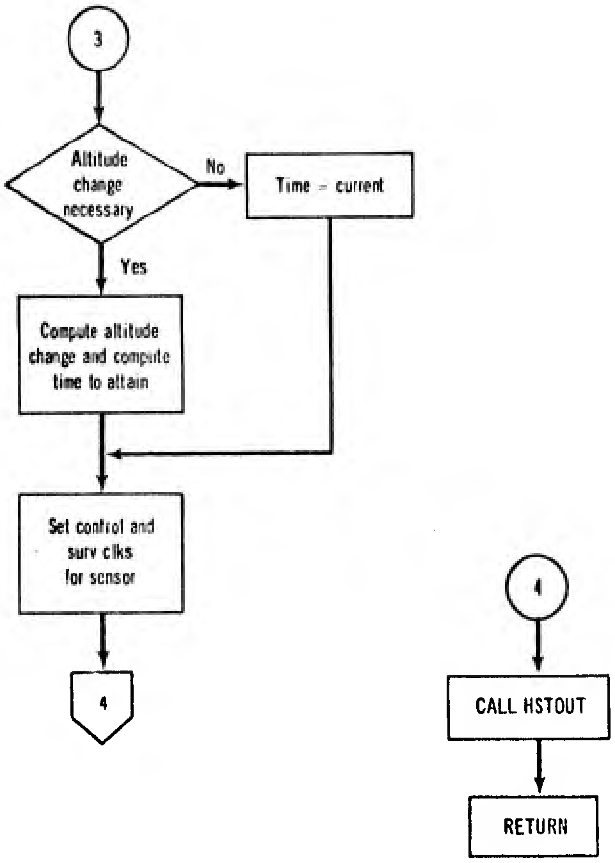
If no change of altitude was necessary to obtain line of sight, control goes to statement 300. LTIME is set to current time, and control goes to 400.


Enter
Extract type of altitude change
Extract mobility class, std alt increment, current altitude
Change to treetop
Yes
1
No
Change to land
Yes
2
No
Extract target info
LOS to tgt(s)
Yes
3
No
Set tactics clk for new mission
4


1
Compute time to descend to treetop; compute altitude
Set clk for tactics, time; and store altitude
4


2
Set time, tactics code, altitude = 0
4

CHGVRT P.2


3
Altitude change necessary
No
Time = current
Yes
Compute altitude change and compute time to attain
Set control and surv clks for sensor
4
4
CALL HSTOUT
RETURN

CLARTY

Purpose:	When artillery support is called for by a weapon or command unit this subroutine will select the artillery unit to fire and the target.
Arguments:	Labeled common MAIN, CNTRL, TGTSL, HSTDAT.
Called by:	TGTSEL for weapon units and DECIDE for command units.

This subroutine is called by TGTSEL if the weapon unit is authorized to call artillery, has been fired upon, and is at least partially suppressed by an enemy unit to which it is vulnerable. These potential targets are on the MX list. If a command unit is authorized to call artillery and has nearest-square information on units on its priority list the call will be from subroutine DECIDE. These potential targets are in the MTARTY array.

If CLARTY is entered from DECIDE, the MX list is constructed in the DO 50 loop. NOAMMO is a switch that is used to reroute control through the program again if the artillery unit selected is out of ammunition.

Array ITGRID (48,2) contains the coordinates (packed) of the center of impact of the last firing of the corresponding artillery unit. This prevents more than one artillery unit from firing at the same square as the center of impact. If bit 14 of the JATRIB word is ON, the unit can provide support and the corresponding work in ITGRID is cleared. The DO 30 loop checks this bit for all units. If the unit elects to fire later in the routine the bit will be turned OFF, and the ITGRID location refilled. The bit is turned back ON in NEWMIS after the last volley of this firing has been assessed.

At statement 31, if a command unit called artillery its subordinate units are checked for a unit which can provide artillery support in the DO 226 loop. If no such unit is found, control is returned to the calling routine. If a weapons unit called artillery, all units are checked to determine if support is available. The unit index is incremented at statement 230. In each case a random number is compared against the fraction of time unavailable. As the battle area is limited in the simulation, the fraction of time unavailable represents the time spent in firing at targets not in the 60 × 63 grid area. This is input from form Unit 3 (UNT3).

The DO 248 loop checks the MX list, and targets on the list are counted in NTGT, their coordinates entered in IXTT, IYTT arrays. The coordinates are packed in ITLOC and compared with ITGRID. If equal, NTGT is decremented and the target taken off the MX list.

The DO 260 loop lists all those targets that are on the MX list and within range of the weapon, on the MTM list, and the count entered on KOUNT. If KOUNT equals one that target is selected, if greater than one the number in KOUNT is selected by random number reference. The DO 270 loop places the target number in MTGT.

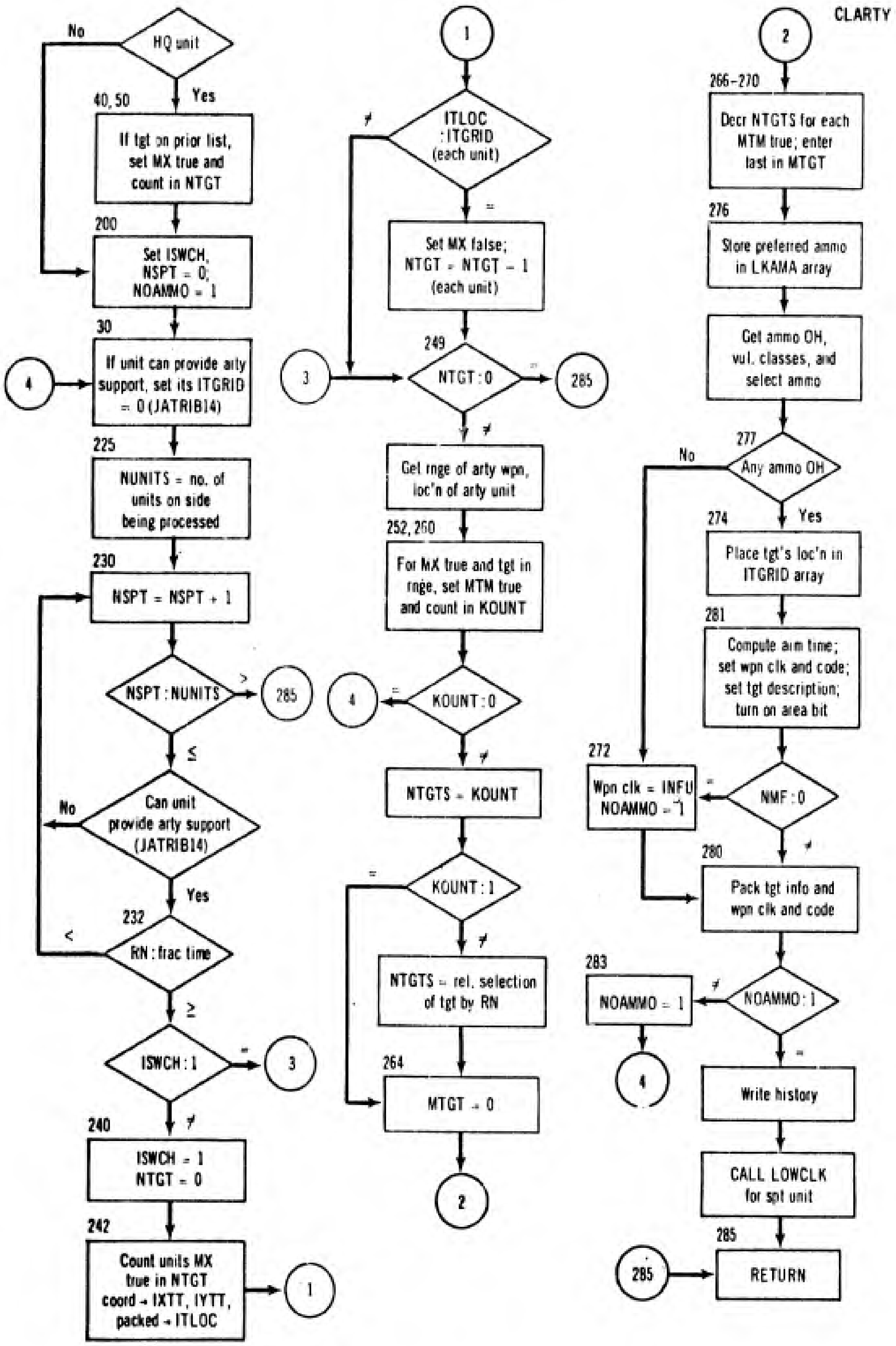
Ammunition type is selected by checking preferred type against vulnerability class of target. If the preferred type is not on hand the other type is selected. If no ammunition is available the weapon's event clock is set to upper infinity and NOAMMO is checked.

If ammunition is available, aim/reaim time plus current time is computed and entered in the weapon's event clock. The event code is set to "end aiming" (firing). The bit indicating an area target is turned ON.

The number of men firing is set to the smaller of crew required and men available, and with weapon number, target number, target location, ammunition type, and number of shots (volleys) is packed in the target description word. The bit indicating able to provide support is turned OFF.

If NOAMMO is not equal to one, it is set to one and control goes to statement 31 for another attempt to select a support unit. In this case statements 240 to 249 are bypassed (ISWCH = 1) as it is not necessary to recount the number of targets in NTGT.

If NOAMMO is equal to one, the history message is stored, the support units lowest clock is entered in its master clock and control returns to the calling subroutine.


CLARTY
HQ unit
No
Yes
40, 50
If tgt on prior list, set MX true and count in NTGT
200
Set ISWCH, NSPT = 0; NOAMMO = 1
30
4
If unit can provide arty support, set its ITGRID = 0 (JATRIB14)
225
NUNITS = no. of units on side being processed
230
NSPT = NSPT + 1
NSPT : NUNITS
>
285
≤
Can unit provide arty support (JATRIB14)
No
Yes
232
RN : frac time
<
≥
ISWCH : 1
=
3
≠
240
ISWCH = 1
NTGT = 0
242
Count units MX true in NTGT coord → IXTT, IYTT, packed → ITLOC
1
1
ITLOC : ITGRID (each unit)
≠
=
Set MX false; NTGT = NTGT − 1 (each unit)
249
3
NTGT : 0
=
285
≠
Get rnge of arty wpn, loc'n of arty unit
252, 260
For MX true and tgt in rnge, set MTM true and count in KOUNT
4
=
KOUNT : 0
≠
NTGTS = KOUNT
KOUNT : 1
=
≠
NTGTS = rel. selection of tgt by RN
264
MTGT = 0
2
2
266–270
Decr NTGTS for each MTM true; enter last in MTGT
276
Store preferred ammo in LKAMA array
Get ammo OH, vul. classes, and select ammo
277
Any ammo OH
No
Yes
274
Place tgt's loc'n in ITGRID array
281
Compute aim time; set wpn clk and code; set tgt description; turn on area bit
272
Wpn clk = INFU
NOAMMO = 1
=
NMF : 0
≠
280
Pack tgt info and wpn clk and code
283
NOAMMO = 1
≠
NOAMMO : 1
=
4
Write history
CALL LOWCLK for spt unit
285
285
RETURN

CLHCPR (Call helicopter)

Purpose: When a command unit calls for helicopter support this subroutine selects the target and the helicopter unit, if one is available, to answer the call. If one is available its tactic clock and code are set for immediate call to NEWMIS.

Arguments: Labeled common MAIN, CNTRL, HSTDAT.

Called by: DECIDE

At statement 21 the array for the x-coordinate of potential targets, IXHT, is cleared. The target list, MTHELO, of the command unit which called helicopter is checked for targets. (The target was set up in DECIDE.) If there are targets in MTHELO, their coordinates and altitude are entered in IXHT, IXHY, and ITALT, and the targets counted in NOTGTS (DO 1). If there are not targets, control is returned to the calling routine.

If there are targets the command units location and altitude are stored in IXCU, IYCU, and IALT. The range from the command unit to the nearest target is computed and stored in IRC. The number of the last target on the list with the range is stored in MTG (DO 2).

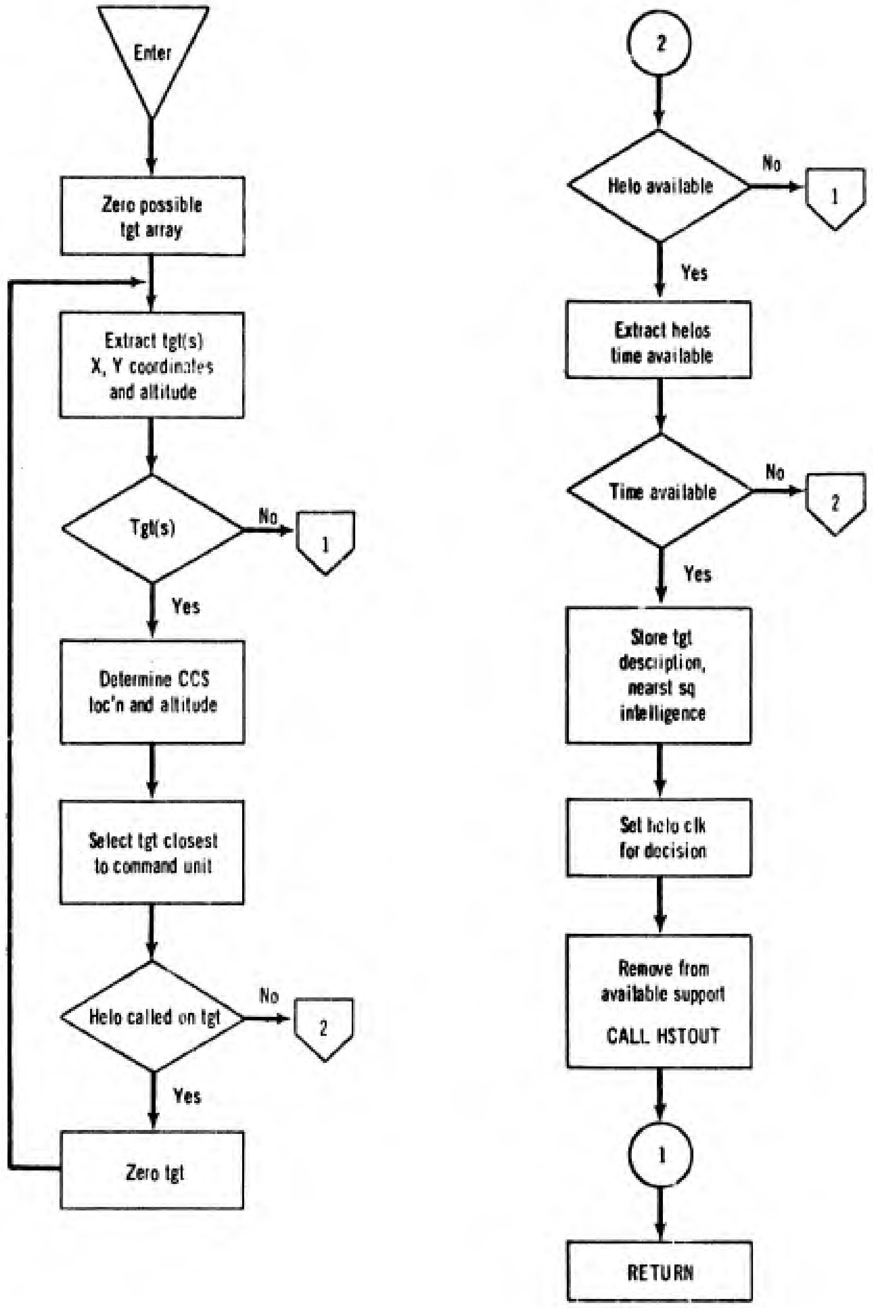
The DO 40 loop checks all units to determine if a helicopter has been called against this target and has not completed its mission. If this is the case, the target is removed from the MTHELO list and control goes back to statement 21.

If no helicopter is on a mission against this target, control enters the DO 14 loop. The subordinate weapons units of this command unit are checked to determine if they can provide air support. If none can, control returns to main program. If a subordinate unit can provide air support control goes to statement 12 and the first such unit encountered is entered in NSUP.

The target information is stored in JUCHAR. The target number is stored two times for repeated pop-ups. The helicopter unit is given nearest square information on the target. The helicopter tactic clock and code are set to current time plus one and tactic, and packed into JCNTRL. The control code is set to decision.

The helicopter's "support available" bit in JATRIB is turned off, the history message is stored, LOWCLK is called for the helicopter unit, and control returned to the calling routine.

CLHCPR P.1


Enter
Zero possible tgt array
Extract tgt(s) X, Y coordinates and altitude
Tgt(s)
No
1
Yes
Determine CCS loc'n and altitude
Select tgt closest to command unit
Helo called on tgt
No
2
Yes
Zero tgt
2
Helo available
No
1
Yes
Extract helos time available
Time available
No
2
Yes
Store tgt description, nearst sq intelligence
Set helo clk for decision
Remove from available support
CALL HSTOUT
1
RETURN

COMMO

Purpose: The communications subroutine passes intelligence information from a command unit to its superior unit, to its subordinate command and weapons units, and from a weapons unit to its command unit. The only information passed through a command unit is nearest square and enemy units known dead. If a weapon unit has EPP information and is in TGTACQ, SURV calls communications. The communication cycle sets up the call for command units from EXEC2.

Arguments: Labeled common MAIN, CNTRL, SURVEL.

Called by: EXEC2, SURV.

If the unit being processed is a command unit, processing starts at statement 10. MI2 and known dead are set for this unit. The superior headquarters unit for this command unit is entered in MBOSS. A maximum of six subordinate headquarters units are entered in the first words of MYLT. The subordinate weapons units are entered in MYMEN (up to eight are permitted) (DO 16). The MI2 and known dead information is combined with that of the superior unit in the superior units file. The same process is repeated for the subordinate command units (DO 17). The information is then added to the JINTEL array of the subordinate weapons unit (DO 18). The communications clock for the command unit is increased by the communications cycle and packed in JCCS for the command unit, and control is returned to EXEC2.

If the unit being processed is a weapons unit, its superior command unit is transferred from JUCHAR to MBOSS (statement 2). EPP* information for the weapons unit is transferred as NS information for the command unit in JCMD (DO 25). The process is repeated for enemy known dead, and control is then returned to SURV.

---

*Erroneous Pinpoint, Intelligence Level 3.

DEAD

Purpose:	To turn the dead bit on in JATRIB or JCCS. To set all clocks, except weapons event clocks in certain cases discussed below, to upper infinity. Set air units altitude to zero.
Arguments:	ITG, the target which was killed, IXT and IYT, its coordinates. Labeled common MAIN, CNTRL, CLOCK.
Called by:	DECIDE, if a command unit, NEWMIS, if due to a faulty order, and IMPACT.

Command and weapon units are processed separately. If a weapon unit is being processed, the target unit number (the unit killed), is stored in ITG1, and its side in ISIDE. The control clock, tactic clock, and both surveillance clocks are set to upper infinity.

The DO 40 loop sets all weapons' loading clocks to upper infinity; if the weapon event clocks show a weapon available, its event clock is set to upper infinity. If the event clock shows the weapon busy, the weapon event code is extracted from JCNTRL. If the weapon requires guidance, and the code is "assess" the clock is unchanged, if the code is not "assess," the clock is set to upper infinity. If the weapon does not require guidance, and the code is "target select" or "end aiming," the clock is set to upper infinity, otherwise the clock is unchanged. This loop will abort the firing of a guided missile when impact has not occurred. If not a guided missile the clocks will not be set to upper infinity until after assessment. In both cases the clock is set in subroutine ASSESS.

After exit from DO 40, LOWCLK is called to place the lowest clock in the unit's master clock. This is to process impact or assessment for the above cases. The "dead" bit is turned ON and the move bit turned OFF in JATRIB. If the unit is infantry the "pinned down" bit in JATRIB is turned ON and response states "one" and "two" bits (partially suppressed by direct or indirect fire) are turned OFF; control then goes to statement 300.

Processing command units starts at statement 200. The master clock of the command unit is set to upper infinity. All clocks; control, tactic, surveillance devices one and two, and communications are set to upper infinity. The command unit number is entered into ITG1. The side, MSIDE, and the coordinates of the unit, IXS and IYS, are stored in ISIDE, IXT, and IYT since the call came from DECIDE, and the unit being processed is the unit killed rather than the target unit. The "dead" bit is turned ON in JCCS. Control then passes to statement 300.

At statement 300, current time is floated and scaled and stored in BTIME for printing. The altitude is entered in IZT, and if the unit is a command unit, is set to zero. This is necessary as the command unit's buddy unit might have been an air unit not on the ground. The DEAD message is printed. This is the only printout from the battle model except in the case of a faulty order. If the target (ITG) is an aircraft, its altitude is set to zero. Control then returns to calling routine.

DECIDE

Purpose:	This subroutine sets up the call to target select for suppressive fire orders and depending on orders, will call BDMONT, BMOUNT, CHGVRT, or MOVE. Selects a new buddy unit for command units where buddy unit is dead. If a command unit has nearest square information on an enemy target that is on its helicopter or artillery priority list, this subroutine will call for the appropriate support.
Arguments:	JSWICH (controls routing after return to EXEC2), labeled common MAIN, CNTRL, TREAT.
Called by:	EXEC2

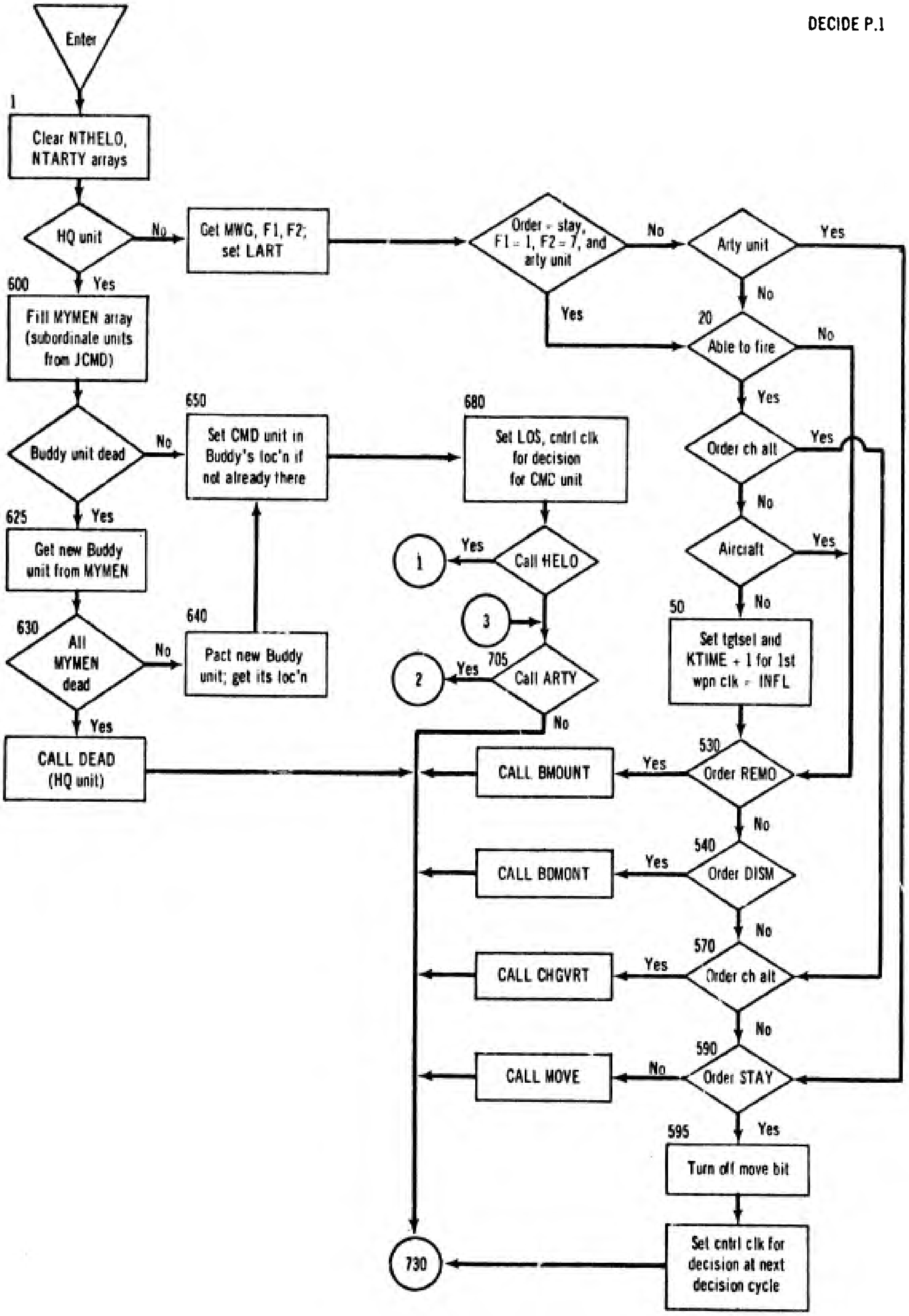
The MTHELO and MTARTY (helicopter and artillery target) arrays are cleared. Command unit processing then starts at statement 600.

For processing of weapon units; if artillery and suppressive fire, control goes to statement 20; if artillery and not suppressive fire, control goes to statement 590 to check if the current order is "move." Other weapon units processing also starts at statement 20. If the order is change altitude, control goes to 570. If helicopter and a stay order (helicopter on call), control goes to 530. If the unit is an artillery unit (it will have a suppressive fire order here, the DO 30 loop is entered and weapon event clock is set to current time plus one and the event code to target select).

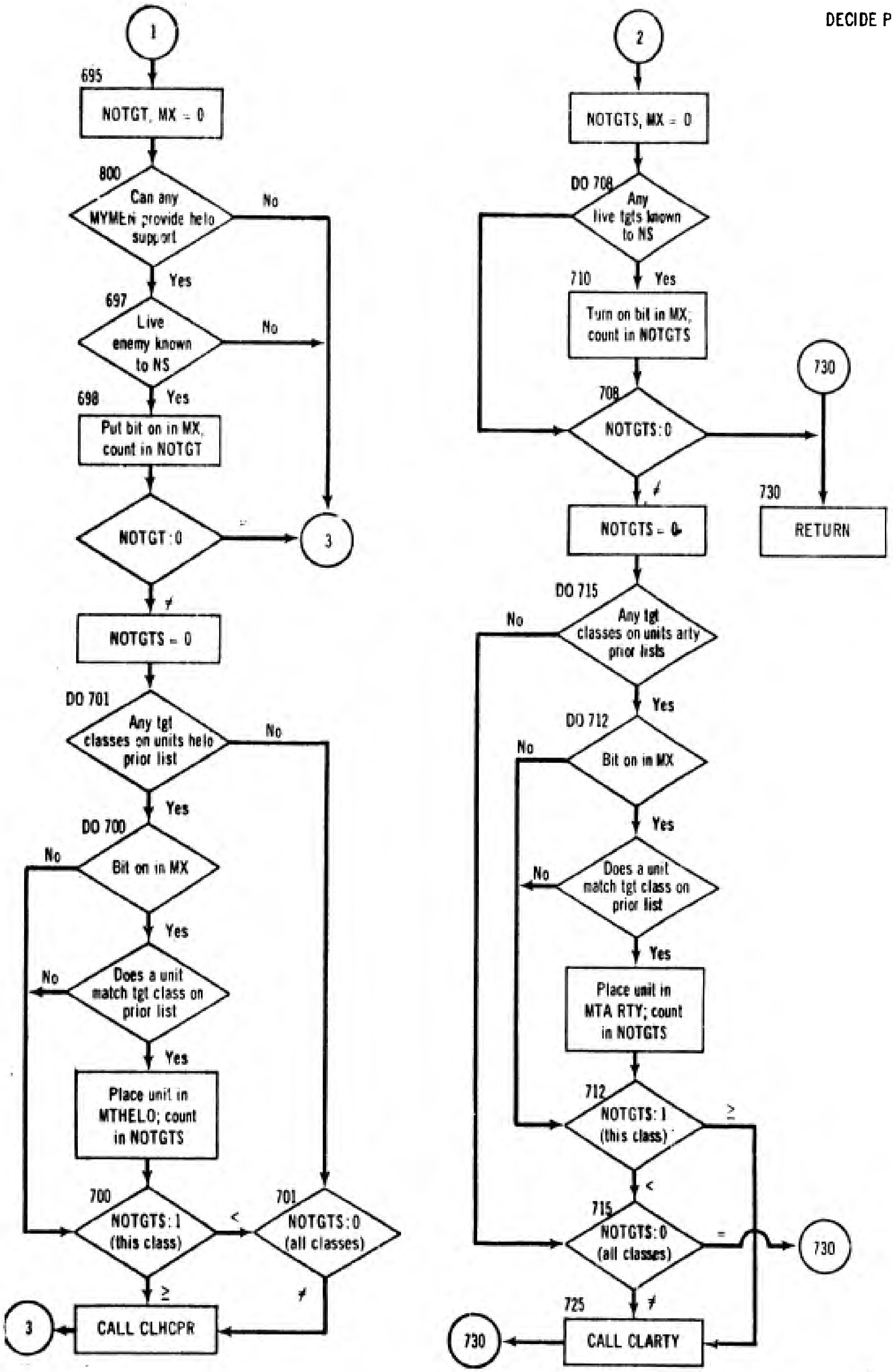
Starting at statement 530 routings are to call BMOUNT, BDMONT, CHGVRT, or MOVE depending on MWG of the current order. In each case JSWICH is set to control routing after return to EXEC2. If none of the subroutines are called the control clock is set to current time plus decision cycle and code to decision; which sets the next call to DECIDE and return is made to EXEC2.

Command unit processing starts at statement 600. If the command unit's buddy is dead, a new buddy unit is selected from the weapon units subordinate to the command units. If all weapon units are dead, the command unit is killed. If the command unit is not in the same square with the buddy unit, the command unit is moved to the new buddy unit's location. If the command unit is authorized to call for helicopter support control goes to 695. The weapon units array (MYMEN) subordinate to this command unit is searched for a helicopter unit that can provide support (DO 800). If the command unit has nearest square intelligence on an enemy unit, the corresponding bit is turned on in MX, and the targets counted in NOTGT (DO 697). The bit pattern in MX is then checked against the target priority classes in IHELO and if matched, the target number is entered into the MTHELO array and the targets counted in NOTGTS (DO 701). If NOTGTS is not equal to zero, control goes to statement 702.

Starting with statement 705, artillery is checked in the same manner against the priority list in array IARTY, and if there are targets the number is placed in MTARTY and at statement 725, artillery is called CLARTY). Control is than returned to EXEC2.


Enter
1
Clear NTHELO, NTARTY arrays
HQ unit
No
Get MWG, F1, F2; set LART
Order = stay, F1 = 1, F2 = 7, and arty unit
No
Arty unit
Yes
600
Yes
Fill MYMEN array (subordinate units from JCMD)
Yes
No
20
Able to fire
No
Yes
650
Set CMD unit in Buddy's loc'n if not already there
680
Set LOS, cntrl clk for decision for CMD unit
Buddy unit dead
No
Order ch alt
Yes
625
Yes
No
Get new Buddy unit from MYMEN
1
Yes
Call HELO
Aircraft
Yes
No
640
3
50
Set tgtsel and KTIME + 1 for 1st wpn clk = INFL
630
All MYMEN dead
No
Pact new Buddy unit; get its loc'n
2
Yes
705
Call ARTY
No
Yes
530
CALL DEAD (HQ unit)
CALL BMOUNT
Yes
Order REMO
No
540
CALL BDMONT
Yes
Order DISM
No
570
CALL CHGVRT
Yes
Order ch alt
No
590
CALL MOVE
No
Order STAY
595
Yes
Turn off move bit
730
Set cntrl clk for decision at next decision cycle

DECIDE P.2


1
695
NOTGT, MX = 0
800
Can any MYMEN provide helo support
No
Yes
697
Live enemy known to NS
No
Yes
698
Put bit on in MX, count in NOTGT
NOTGT : 0
=
3
≠
NOTGTS = 0
DO 701
Any tgt classes on units helo prior list
No
Yes
DO 700
Bit on in MX
No
Yes
Does a unit match tgt class on prior list
No
Yes
Place unit in MTHELO; count in NOTGTS
700
NOTGTS : 1 (this class)
<
701
NOTGTS : 0 (all classes)
≥
≠
3
CALL CLHCPR
2
NOTGTS, MX = 0
DO 708
Any live tgts known to NS
710
Yes
Turn on bit in MX; count in NOTGTS
730
708
NOTGTS : 0
≠
730
NOTGTS = 0
RETURN
DO 715
No
Any tgt classes on units arty prior lists
Yes
DO 712
No
Bit on in MX
Yes
No
Does a unit match tgt class on prior list
Yes
Place unit in MTA RTY; count in NOTGTS
712
NOTGTS : 1 (this class)
≥
<
715
NOTGTS : 0 (all classes)
=
730
725
≠
730
CALL CLARTY

DESTGT (Designate Target)

Purpose: This subroutine actually makes the final target selection for TGTSEL for non-suppressive fire.

Arguments: Labeled common MAIN, TGTSL, TREAT, CNTRL, HSTDAT.

Called by: TGTSEL.

The vulnerability class and pinned-down status for each target on the MTL2 list are recorded in the LCVA and LFR1A arrays (DO 2). The DO 3 loop transfers preferred ammo type for the weapon considered for each vulnerability class into array LKAMA. The number of targets on the MTL2 list are counted in NTGT. If NTGT equals one, the target number of the target selected is moved into NXTG and its coordinates into IXT1 and IYT1 (DO 380). Control then goes to statement 460.

If NTGT is greater than one, a check is made to determine if the closest or farthest targets are to be selected. If it is the closest targets the closest range is stored in NRNJ (DO 400). If it is the farthest range the farthest range is stored in MRNJ (DO 420).

At statement 430 (DO 440) targets at range NRNJ are listed in NADA array, the last target number going into NXTG.

Targets in NADA are then counted in NTGT; if there is only one the target selected is in NXTG and control goes to statement 460.

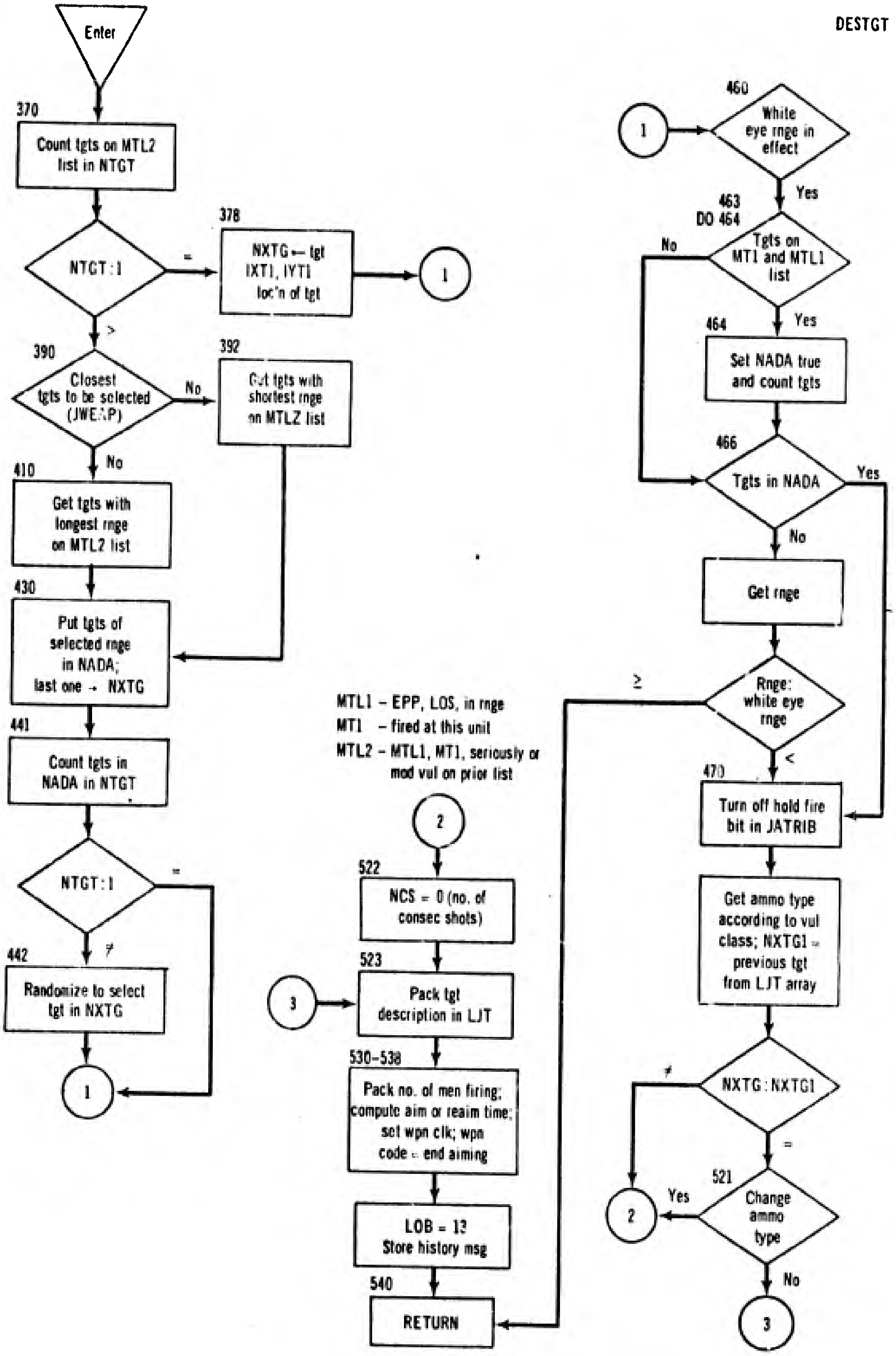
At DO 450 (if NTGT is greater than 1) the number in NTGT is selected by randomization.

Statement 460 checks to determine if the side should hold fire until the enemy is within a certain range or until the enemy opens fire (logical variable LEYE). If TRUE, the MTL1 list is checked (DO 466), and then the MT1 list is checked. If both are TRUE, the corresponding variable in NADA is set to TRUE and the unit counted in NTGT. If there are no such targets the range is computed to the target selected (NXTG) and this compared with the hold fire range (KWER). If the range is greater than or equal to the hold fire range, the program returns to TGTSEL; if not, the hold fire bit is turned OFF in JATRIB.

If LEYE was FALSE the MTL1, MT1 and KWER checks are bypassed. At statement 510, the vulnerability class of the target is extracted and the preferred ammo type is entered into IA. If no ammo of either type is on hand, program returns to TGTSEL.

At statement 520, a check is made to determine if this target was the last one selected by this unit and the same ammo type used. If it was not, the number of consecutive shots is set to zero and JHIT, indicating the previous round hit, is set to zero.

The target description is packed into LJT. The number of men available to fire is checked and if insufficient, return is made to calling routine. The aim/reaim time is computed and the weapon's event clock is set to current time plus aim time, and the weapon's event code set to "end aiming" (firing). The history message is stored and program returns to TGTSEL.


Enter
370
Count tgts on MTL2 list in NTGT
NTGT : 1
=
378
NXTG ← tgt IXT1, IYT1 loc'n of tgt
1
>
390
Closest tgts to be selected (JWEAP)
No
392
Get tgts with shortest rnge on MTLZ list
No
410
Get tgts with longest rnge on MTL2 list
430
Put tgts of selected rnge in NADA; last one → NXTG
441
Count tgts in NADA in NTGT
NTGT : 1
=
≠
442
Randomize to select tgt in NXTG
1
2
522
NCS = 0 (no. of consec shots)
523
3
Pack tgt description in LJT
530-538
Pack no. of men firing; compute aim or reaim time; set wpn clk; wpn code = end aiming
LOB = 13 Store history msg
540
RETURN
1
460
White eye rnge in effect
Yes
463
DO 464
No
Tgts on MT1 and MTL1 list
Yes
464
Set NADA true and count tgts
466
Tgts in NADA
Yes
No
Get rnge
≥
Rnge: white eye rnge
<
470
Turn off hold fire bit in JATRIB
Get ammo type according to vul class; NXTG1 = previous tgt from LJT array
≠
NXTG : NXTG1
=
521
2
Yes
Change ammo type
No
3

MTL1 – EPP, LOS, in rnge
MT1 – fired at this unit
MTL2 – MTL1, MT1, seriously or mod vul on prior list

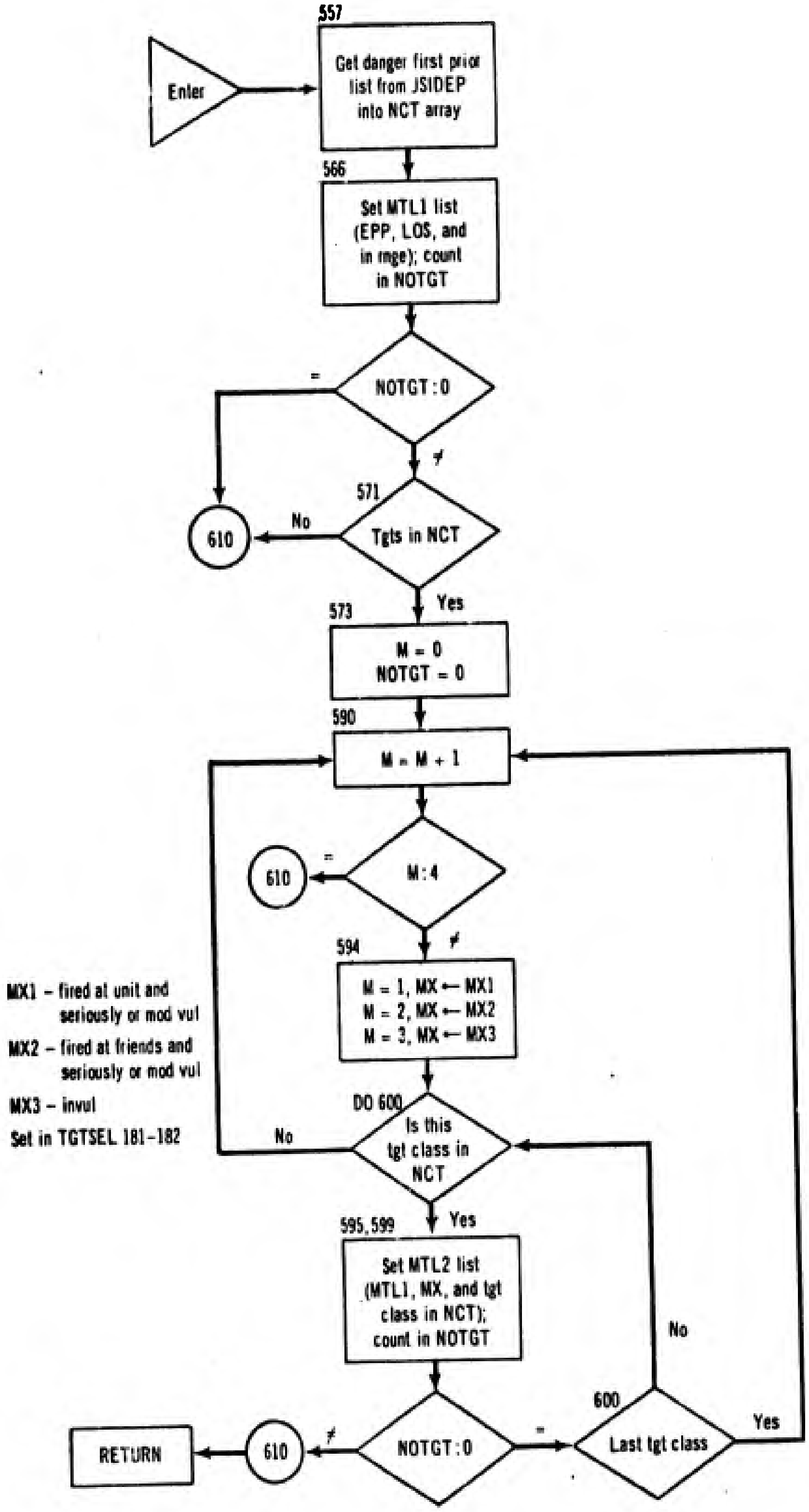
DGFRST (OPFRST)

Prupose:	To build the MTL2 list, depending on whether the TGTSEL routine follows the "danger first" or "opportunity first" path. Both subroutines are the same depending on which priority list is transferred into the NCT array.
Arguments:	Labeled common MAIN, TGTSL, COMM, CNTRL.
Called by:	TGTSEL.

The appropriate priority list (from opportunity or danger) is transferred from JSIDEP into NCT. The MTL1 list is constructed (DO 570) and its targets counted in NOTGT. If there are no targets, control is returned to TGTSEL. Control is also returned to TGTSEL (DO 572) if there are no targets in NCT.

The MTL2 list is constructed from targets whose target class is in NCT and the target on MTL1 and an MX list. The MX1 list is checked first and if it contains targets, no further MX check is made. If not, MX2 is checked and if it contains targets MX3 is not checked. The number of targets on the MTL2 list are counted in NOTGT. Control is then returned to TGTSEL.

DGFRST


Enter
557
Get danger first prior list from JSIDEP into NCT array
566
Set MTL1 list (EPP, LOS, and in rnge); count in NOTGT
NOTGT : 0
=
≠
571
Tgts in NCT
No
610
Yes
573
M = 0
NOTGT = 0
590
M = M + 1
M : 4
=
610
≠
594
M = 1, MX ← MX1
M = 2, MX ← MX2
M = 3, MX ← MX3
DO 600
Is this tgt class in NCT
No
Yes
595, 599
Set MTL2 list (MTL1, MX, and tgt class in NCT); count in NOTGT
NOTGT : 0
≠
610
RETURN
=
600
Last tgt class
No
Yes

MX1 – fired at unit and seriously or mod vul

MX2 – fired at friends and seriously or mod vul

MX3 – invul

Set in TGTSEL 181–182

FIRING

Purpose: This subroutine fires the weapon, except under conditions noted below, and keeps record of ammunition on hand.

Arguments: Labeled common MAIN, CNTRL, IMPFIR, HSTDAT

Called by: EXEC2.

During initialization the temporary storage for the weapon event clock, LWCLK, and the loading clock, LLCLK, are set to lower infinity. If the unit is moving and its firing order contains "kind 4," control goes to statement 111 (the unit cannot fire). If the number of men firing is zero (set in TGTSEL or DESTGT), control goes to statement 70 where LOSTIT is set to one, and the target word for this weapon is cleared. If there are no targets for the unit's other weapons, LOSTIT is set equal to two, and the weapon event clock and code are set to current time plus one and "target select," and control goes to statement 111. If there are targets for the other weapons, resetting LOSTIT and weapons clock and code are bypassed.

If there is a crew available, the coordinates of the target are extracted from LJT for area fire and the target number from LJT and coordinates from JCNTRL for non-area fire. The ammo type, kind and priority of fire are stored.

If this is the main weapon and priority is seven, or if kind is 1 or 3, and main weapon, and not direct fire, control goes to statement 50 where weapon information is unpacked and range to target computed. If target is out of maximum or minimum range, control goes to 70 (above). If this is not the main weapon, or is direct fire if the main weapon, line of sight is checked. If LOS does not exist control goes to 70 (above); if is does exist, control goes to 50 (above).

If kind of fire is not 1, 3, or 7, LOS is checked; if it does not exist control goes to 70, if it exists control goes to 40. If EPP exists and target is not known dead, control goes to 50, otherwise to 70.

After statement 50 if the target is in range, control goes to statement 1 where weapon information is unpacked, rounds to be fired are computed and ammo on hand is updated. If this is the last of the ammo, the message is stored here.

If there are remaining volleys to be fired, the number to be fired is decremented (statement 185). If the fire is not area fire, ITP is set. (See notes on chart.)

The time of flight is then computed (statement 192), and the weapon event time and code set to current time plus time of flight and "impact."

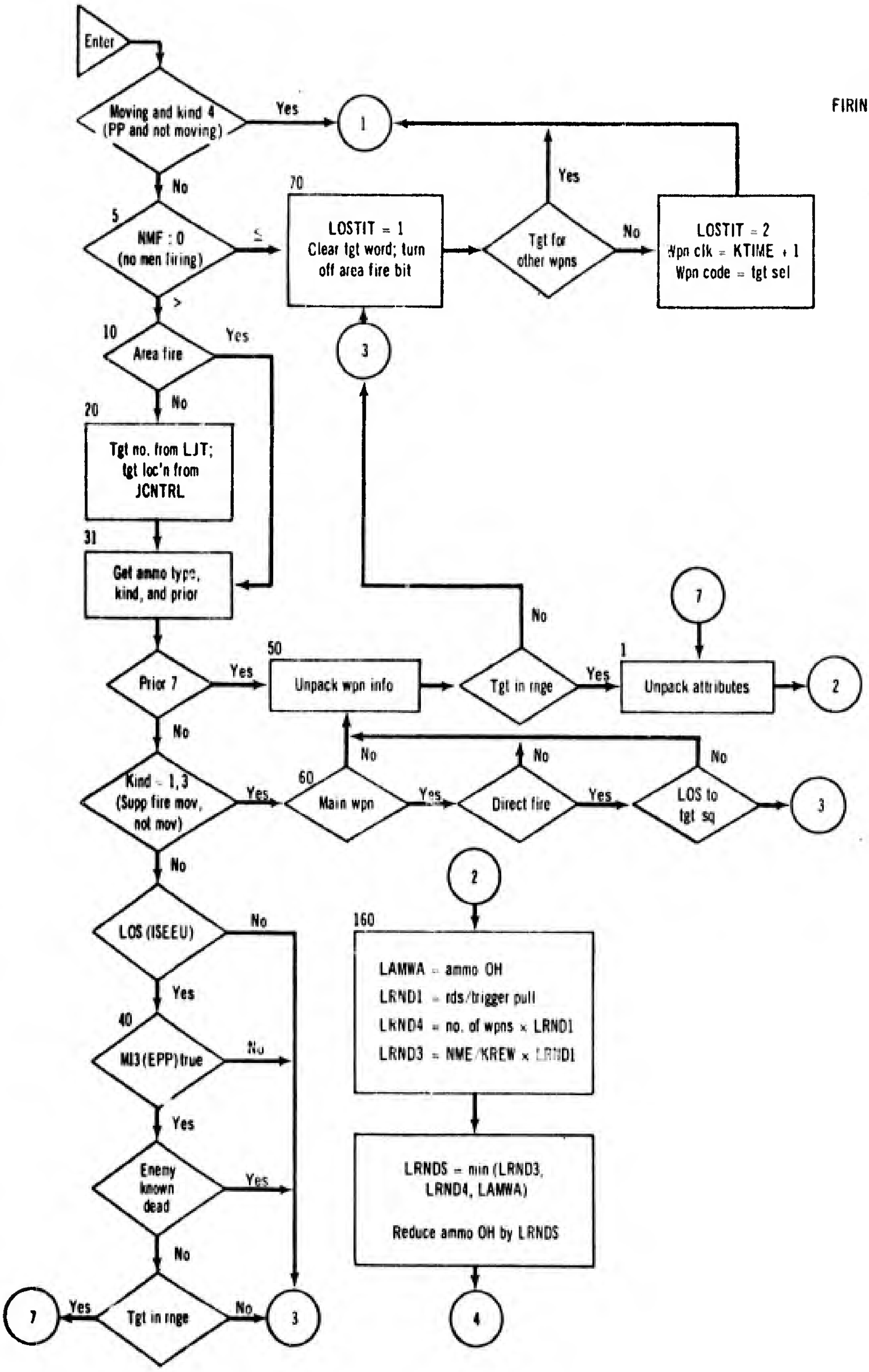
If the weapon requires guidance, the tactics clock is extracted, and if the weapon clock plus assessment time is not less than the loading clock, the tactics clock is set to lower infinity and repacked. This is to keep out of NEWMIS until after assessment. If no ammo is left after this firing, the loading clock is set to upper infinity and control goes to statement 315. If ammo is left, reload time is computed and if firings remain under this order the loading clock is set to current time plus reload time and code is set to "end loading." (Since the weapon is already aimed this will be the time to fire the next volley.)

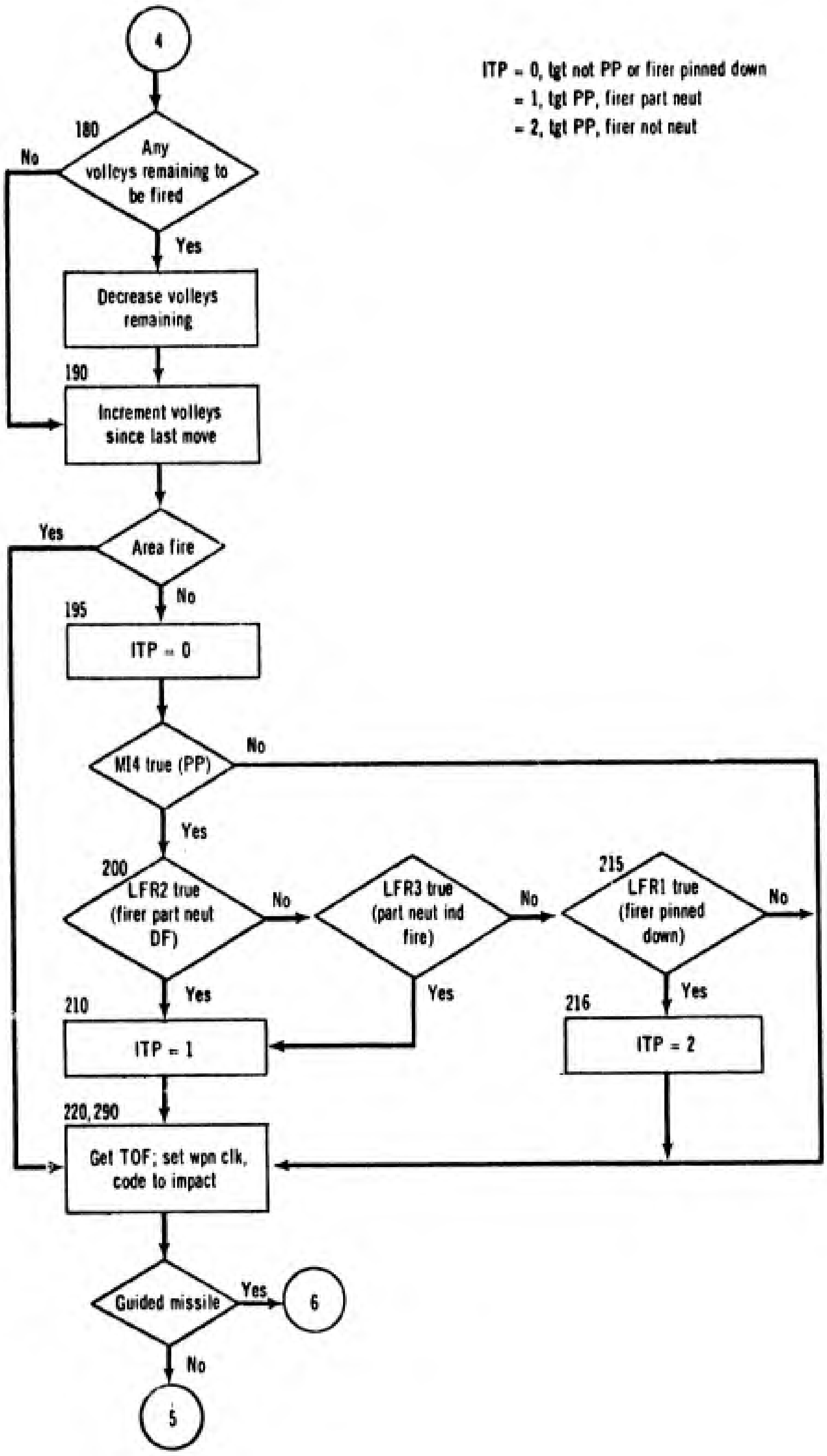
At statement 315 the index for packing weapon information is computed and the characteristics and ITP are packed. The target description is packed (110) and the control word is packed. The location of the unit when firing took place is stored in IWASAT for use in range computation in IMPACT, in case the firer has moved before IMPACT.

At this point if the unit is moving and has firing order "kind 4," control returns to calling program. If LOSTIT equals zero, the history message is stored, if not the history message is bypassed.

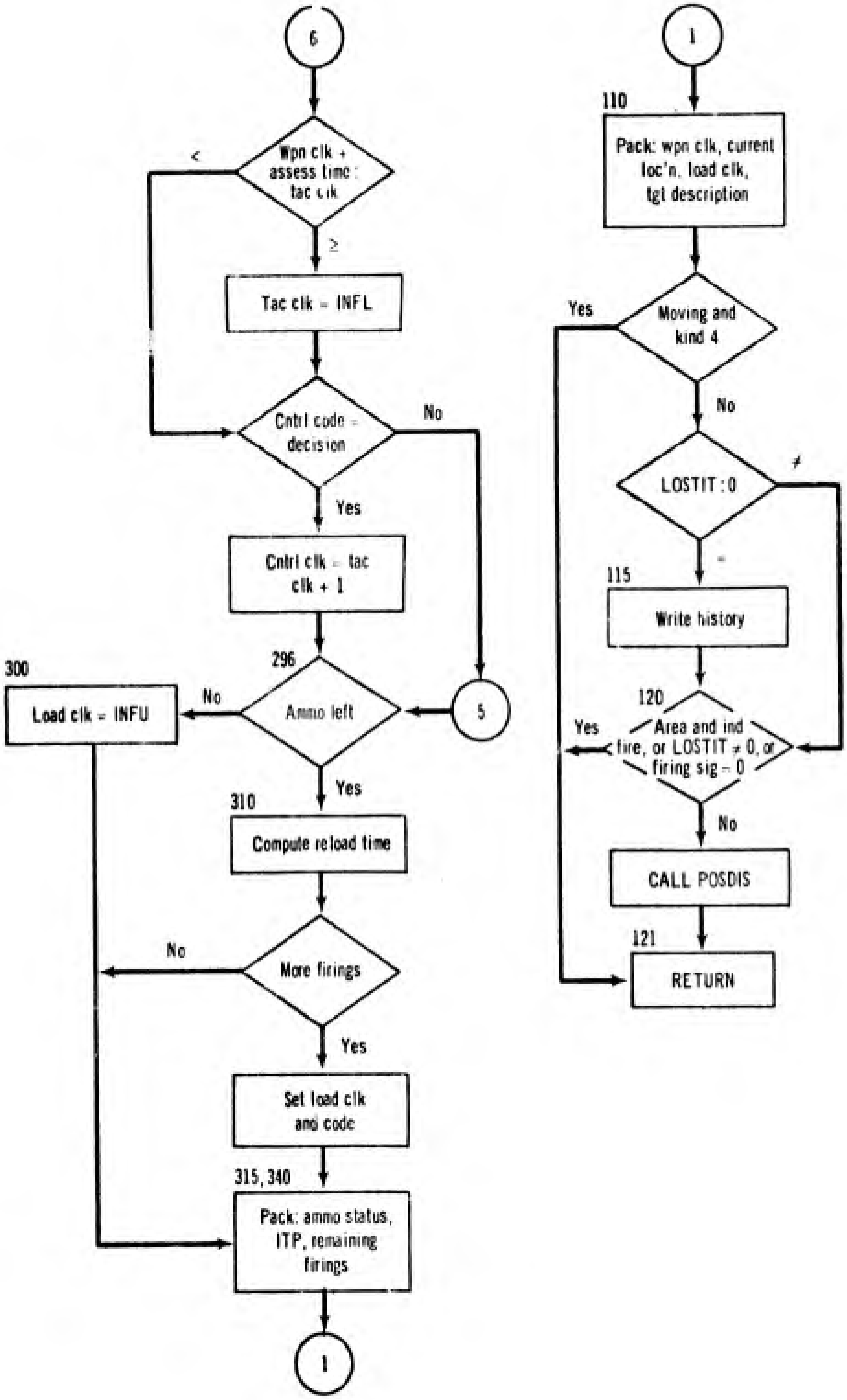
At statement 120 if "area fire" and "indirect fire" and "firing signature" not equal to zero and LOSTIT indicates target was lost, control is returned to EXEC2. Otherwise subroutine POSDIS is called before returning to calling routine.

FIRING P.1


Enter
Moving and kind 4 (PP and not moving)
Yes
1
No
5
NMF : 0 (no men firing)
≤
>
70
LOSTIT = 1 Clear tgt word; turn off area fire bit
Tgt for other wpns
Yes
No
LOSTIT = 2 Wpn clk = KTIME + 1 Wpn code = tgt sel
3
10
Area fire
Yes
No
20
Tgt no. from LJT; tgt loc'n from JCNTRL
31
Get ammo type, kind, and prior
7
No
50
Prior 7
Yes
Unpack wpn info
Tgt in rnge
Yes
1
Unpack attributes
2
No
Kind = 1, 3 (Supp fire mov, not mov)
Yes
60
Main wpn
Yes
Direct fire
Yes
LOS to tgt sq
3
No
No
No
No
LOS (ISEEU)
No
Yes
40
M13 (EPP) true
No
Yes
Enemy known dead
Yes
No
7
Yes
Tgt in rnge
No
3
2
160
LAMWA = ammo OH
LRND1 = rds/trigger pull
LRND4 = no. of wpns × LRND1
LRND3 = NME/KREW × LRND1
LRNDS = min (LRND3, LRND4, LAMWA)
Reduce ammo OH by LRNDS
4


4
180
Any volleys remaining to be fired
No
Yes
Decrease volleys remaining
190
Increment volleys since last move
Yes
Area fire
No
195
ITP = 0
MI4 true (PP)
No
Yes
200
LFR2 true (firer part neut DF)
No
LFR3 true (part neut ind fire)
No
215
LFR1 true (firer pinned down)
No
Yes
Yes
Yes
210
ITP = 1
216
ITP = 2
220, 290
Get TOF; set wpn clk, code to impact
Guided missile
Yes
6
No
5

ITP = 0, tgt not PP or firer pinned down
= 1, tgt PP, firer part neut
= 2, tgt PP, firer not neut


6
Wpn clk + assess time : tac clk
<
≥
Tac clk = INFL
Cntrl code = decision
No
Yes
Cntrl clk = tac clk + 1
296
300
Load clk = INFU
No
Ammo left
5
Yes
310
Compute reload time
No
More firings
Yes
Set load clk and code
315, 340
Pack: ammo status, ITP, remaining firings
1
1
110
Pack: wpn clk, current loc'n, load clk, tgt description
Yes
Moving and kind 4
No
LOSTIT : 0
≠
=
115
Write history
120
Yes
Area and ind fire, or LOSTIT ≠ 0, or firing sig = 0
No
CALL POSDIS
121
RETURN

HSTOUT

Purpose: Writes the history messages it receives from other routines on the output tape (tape 4).

Arguments: Labeled common MAIN, RUN, HSTDAT, CNTRL

Called by: MAIN2X, MOVE, BOUNDX, TGTACQ, IMPACT, FIRING, NEWMIS, EXEC2, DESTGT, TGTSEL, CLARTY, BDMONT, RESPNS, BMOUNT, CLHCPR, POSDIS, CHGVRT, KILWPN, STOP1, STOP2, STOP3.

Each message is composed of five words, usually packed, including its code number, LOB. The messages are stored in array JOUT until one hundred messages (five hundred words) are received, then the messages are written on tape. If the array is not full when an "end of replication" message is received, it is completed with zeros before writing.

The first word of each message always contains the unit and side being processed, the replication number, and the treatment number. The second work contains the tenth control word of the unit being processed.

Only two additional words are used for the begin treatment message. (The unit and side are not entered). They contain the treatment number, the grid size, the initial number of blue and red weapon units, the maximum battle time, the number of replications, and the date of the run. The remaining four hundred ninety six words are zeros. No history message is printed, the output being used only for processing.

The only information used for end treatment is the LOB number. No history message is printed.

"Begin replication" message records initial conditions such as number of men, vehicles, weapons, ammunition for each unit. These are used in computing summaries. No history message is recorded.

"End replicaton" records these final conditions. Computer time and last random number are also included in the output.

As a total ninety-six weapon units are possible, there will always be at least twenty zero words in each "begin" and "end replication" output.

The routing to store the words after the second word of the message follows statement 1001, and the statement numbers correspond to the LOB number, except 17 and 2 are exchanged. If the LOB does not exist, the statement will send control back to statement 199. The exception is for LOB 23, "end treatment," which goes directly to 199, as all necessary action will have already been taken.

If it is desired to add a message, the bit pattern in data word, LOBOUT, must be changed. A bit ON in a position indicates that the corresponding LOB is used.

The LOB values and corresponding messages are shown in Part III, page 138.

IHIT (Function)

Purpose: To compute the hit probability after firing.

Arguments: JS, firer and target activity and posture, JSIG, previous round results, if any, MWPT, weapon type, MAXRNG, maximum range of weapon, KRNG1, range to target, JR, target radius. Labelled COMMON MAIN, CNTRL.

Called by: IMPACT.

The tactical standard deviation parameters are extracted from JTACSD, using JS and JSIG as indices, into NA, NB, and NC for the three ranges, zero, .707 maximum, and maximum. The JS and JSIG are described in comments at statement 180 in IMPACT.

Where a is NA, b is NB, and c is NC, R is the range to the target, and M is the maximum range, the total tactical dispersion, S(R), for range R is

$$S(R) = a + \frac{b-a}{\frac{1}{2}M} * R + \frac{(c-2b+a)}{\frac{1}{2}\,M} * \frac{R}{M} * (R-\tfrac{1}{2}M)$$

Multiplying the right side of the equation by $\frac{M^2}{2}$ gives

$$IS = S(R) = a * \frac{M^2}{2} + (b - a) * M * R + (c - 2b + a) * R * (R - \frac{M}{2})$$

The probability of hit is $P(R) = 1\text{-}\exp\left(\frac{r^2}{2S(R)^2}\right)$, where r is the radius of the target. In the program, r is JR and the probability is IP.

IS is computed as $\frac{r}{S(R)}$ scaled 2^{10} by $IS = JR * \frac{M^2}{2} * 1024 * \frac{1}{IS}$

Then $IS = IS * IS * \frac{1}{2} * \frac{1}{2^8}$ gives $IS = \frac{r^2}{2S(R)^2}$ scaled 2^{12}.

Instead of using the exponential to compute the probability, a polynomial approximation to the exponential is used.

$$IP = .034 * IS^3 - 0.298 * IS^2 + 0.899 * IS$$

This is written as $IP = IS * 10^{-3} * (IS * (34 * IS - 298) +899)$

For scaling: $298_{10} = 452_8$

$452_8 \times 2^{12} = 4,520,000_8 = 1,220,608_{10}$

$899_{10} = 1,603_8$

$1,608 * 2^9 = 1,603,000_8 = 460,288_{10}$

These are the coefficients used in the program. Rounding and scaling takes place after each operation. Finally the result is divided by 10^3.

IMPACT

Purpose: To compute casualty assessment and neutralization effect to personnel and vehicles.

Arguments: Labeled common MAIN, CNTRL, TREAT, IMPFIR, HSTDAT.

Called by: EXEC2.

There are several sections for different types of assessment in this subroutine: indirect fire on dismounted infantry, troop carriers, soft vehicles, and other vehicles; direct fire fragmentation ammo on dismounted infantry, and direct fire non-fragmentation ammo on dismounted infantry; direct fire fragmentation and non-fragmentation on vehicles.

The program up to statement 158 is concerned with unpacking. Ammo on hand, by type and total, number of rounds fired at the target, target description, and location of firer at time of firing are unpacked. LTAREA, area fire, is set TRUE or FALSE. The firing order is stored in MWFF. If not "area fire," the target number is entered into ITNO and its location in IMPX1, IMPY1. The type of ammo is stored in IA. If "area fire," the direction, length, and width of the impact area are computed (see page 111). The center of the impact area, and location of ITNO if not area fire are stored in IMPX and IMPY, and the coordinates packed into IMPKK2.

At statement 2000, LGM (guided missile), KDF (direct fire), LLOS (line of sight firer to target), LFR11, LFR21, LFR31 (pinned down, partially neutralized by direct fire, partially neutralized by indirect fire), and MOVE (firer moving or not) are set TRUE or FALSE.

The DO 2 loop sets attributes for all enemy units, unpacks KMAN, JJMENA (current strength), KVEH, JJVEHA (current vehicles), KMI (number of drivers), MMPV (maximum men per vehicle), LCVA (vulnerability class), LCOV2A (net cover index), LLRD1, LLRA1 (direct fire and indirect fire rounds received during current neutralization period), LCTA (target class), LFRT (fire response class), LVEHA (original number of vehicles), MWF1A (kind of fire if moving), LJTA (target description), and KTUBE1 (number of weapons of each type if the unit has vehicles) for each enemy unit.

The number of volleys remaining to be fired under current order of the firing unit is stored in LSMCHK. The next unit in LDMU.

The original number of men and vehicles in the target unit is stored in JJMEN and JJVEH and its target class in LCT.

The DO 3 loop unpacks the probability of indicating death for 12 vulnerability classes into array KBURN. The probability of kill given a hit for weapon types 13-56 for 12 vulnerability classes are unpacked into array LPKHA from JPKILL in the DO 4 loop. The apparent radius for hit, LCOV1 and deployment radius, IRADU (scaled 2^3) are unpacked from JUCHAR. At statement 5 if the firing unit is artillery, the probability of troop survival dismounting from a carrier which has been killed is unpacked from JFRAG in LPKHA (12). MKIL (fragmentation or multiple kill ammo) is set TRUE or FALSE. The maximum range of the weapon is stored in MAXWRG. The DO 6 loop stores the number of weapons of each type, crew and number of men firing for each in arrays KTUBE, KREW, and NMF.

ITP (see notes later), JHIT (previous round hit or miss), and NCS (number of consecutive shots fired at this target) are unpacked from JUCHAR.

The DO 7 loop loads array LPKIHA (1 through 6) from JFRAG, with probability of kill given a hit on infantry by fragmentation ammo for weapon types 1 through 34, by ammo type, net cover, and fire response classes 1 through 3, and 4. The DO 9 loop unpacks the kill probability on vehicles for four vulnerability classes from JFRAG into LPKIHA (7 through 10).

The DO 8 loop stores the X and Y coordinates of all targets in the arrays IXTT and IYTT. The neutralization weight of the firing weapon is stored in NW, IZT, altitude of target is set to zero, and the fire response class of the target stored in LFRT. The range to the target is computed and entered in IR.

At statements 158 and 159, if the firing was indirect and the weapon was the units main weapon, or if area fire, control goes to statement 690. If the weapon requires guidance and line of sight has been lost subroutine

CHANGE is called, control then goes to statement 100. Subroutine CHANGE will set up a call to NEWMIS if this was the last firing of the current order. At statement 160 JSWCH is set equal to one, this will control routing after exit from DO 610. If the target is not pinpointed, control goes to statement 590. If the weapon requires guidance, is the main weapon, and the firer is pinned down, control goes to statement 590. In this case if the firer is not pinned down and the target is a soft vehicle, the apparent radius for hit is stored in TRAD, statement 175. If the weapon does not require guidance, the apparent radius for hit is also stored in TRAD, except for multiple kill against infantry the deployment radius is stored in TRAD (statement 180).

If the unit is an air unit, TRAD is modified by the angle of impact (statement 191).

Beginning with statement 190, JS and JSIG, two of the input parameters for the hit function are set. See comments in program preceding this statement. ITP equal two in this section means target pinpointed and firer not neutralized. The number of consecutive shots (volleys) is incremented by one. The IHIT function is then referenced and the hit probability stored in IP.

Beginning with statement 270, the number of hits are counted in IH. If the random number is less than IP, a hit was scored. IB is the counter for the number of rounds fired, LRNDS.

At statement 300, if there were no hits (IH equal zero), logical variable LTHIT is set FALSE and control goes to statement 590. If there were hits LTHIT is set TRUE, IH is stored in IH1, and the vulnerability class is stored in LCV. If the target is dead, control goes to statement 590. If the target is not dead, the probability of kill given a hit is stored in LPKH. If the ammo is non-fragmentation and the target a soft vehicle, control goes to statement 331. Otherwise, if the target is infantry control goes to statement 480, if not infantry to 331. At 331, if the ammo is fragmentation and the weapon artillery (frag ammo against vehicles) control goes to statement 690.

At statement 340, if the random number is less than LPKH, control goes to statement 390. Each time the random number is not less than LPKH, the number of hits, IH, is decremented. If IH reaches zero without a kill and the target was a soft vehicle, IH is restroed and control goes to statement 480. (If the vehicle was not killed the troops are processed as infantry.) If the target was not a soft vehicle, the switch IW is set to zero. If not a troop carrier (statement 350), control goes to statement 590. If a troop carrier, control passes to 354, and if IW is not equal to one, control goes to statement 590. IW will be set to one after statement 473. The above routing will be taken if there are no hits on a carrier.

If troops can be mounted on remaining carriers in the unit, the DO 370 loop is entered. All weapons clocks which are in existence and do not require guidance and are not awaiting impact or assessment are set to lower infinity. The control clock is set to current time plus twice the dismount time (dismount plus remount). Control then goes to statement 590.

If the hit registered a kill on a vehicular unit by direct fire, control will go to statement 390. The hits, IH, is decremented, and if there are no vehicles in the unit, the current men per vehicle, KMPV (ITNO), and the counters KMPV1 and KMPV2 are set to zero, and control goes to statement 461.

If there are vehicles in the unit, the number of men per vehicle is stored in KMPV (ITNO) and counters KMPV1, KMPV2.

If the unit is a troop carrier with a mounted unit, control goes to statement 392. If not to statement 420.

At statement 392, the probability of survival is stored in LPKH. KMPV1 and KMPV2 are reduced by the number of drivers.

At statement 400, if the random number is less than LPKH, KMPV2 is decremented. If not both KMPV1 and KMPV2 are decremented.

When KMPV2 is depleted, control goes to statement 430.

At statement 420, the kill was against a non-troop carrier unit. The total casualties, KTCAS, is increased by KMPV1, KMAN1 is set to current strength, KMAN(ITNO) less KMPV1, and KMPV1 is set to zero.

At statement 430, the current strength, KMAN(ITNO) is decreased by the current men per vehicle for the target unit, KMPV (ITNO), and increased by KMPV1. Here KMPV1 represents the number of survivors, if the unit was not a troop carrier it would be zero. If there were vehicles surviving, the number of drivers, KMI, is decreased. KMAN1 is then set equal to the new current strength, KMAN(ITNO).

The DO 450 loop reduces the number of weapons of all types in the target unit by the number of weapons per vehicle, since at this point a vehicle has been lost. The killed vehicle is then subtracted from the number of current vehicles, KVEH(ITNO) and added to the vehicular casualties, KVCAS. If no vehicles are now remaining, the number of drivers is set to zero. The number of current vehicles is packed into JUCHAR.

Control then passes to statement 462. If there are no survivors in the target unit, the current men and drivers are set to zero in JUCHAR. Subroutine DEAD is called. If the unit is not a troop carrier, control goes to statement 590. If the unit is a troop carrier, and this section was entered from the indirect fire section (NLOG TRUE), control goes to statement 760; if NLOG is not TRUE, control goes to 590.

If there were survivors at 462, control goes to statement 471. The current men and drivers are packed in JUCHAR. If this section was not entered from the indirect fire section, and there are still hits to be processed, control goes to statement 340. If entered from the indirect fire section and not a troop carrier, control goes to statement 590. If not entered from the indirect fire section, no hits left to be processed, and the unit is a troop carrier, the number of casualties, NCAS, is set equal to the current men per vehicle minus the survivors, KMPV1. The total casualties, KTAS, is incremented by NCAS. The current men, KMAN (ITNO), which was reset at 430 is stored in KMAN1. If the survivors can not be accomodated by the remaining vehicles, control goes to statement 380, to dismount the passenger unit. If survivors can be accommodated and this section was entered from the indirect fire section, control is returned to that section at statement 531. If not indirect fire, the switch, IW, is set to one and control goes to statement 350.

At statement 380, the input parameters to the dismount routine are set and BDMONT is called. KMAN (IXUNIT) and JJMENA(IXUNIT) receive the current strength of the dismounted unit and KMAN(ITNO) the current strenth of the carrier (it will be zero if killed in DEAD, called by BDMONT). The above is necessary to make the history message and the event summaries compatible in the post processor. If this section was entered from indirect fire, control goes to statement 760, if not to statement 590.

Statement 480 starts processing non-fragmentation ammunition on infantry. The probability of kill given a hit, LPKH, for the vulnerability class of this target was stored at statement 330. Each hit is processed separately, turning on the bit number in LKILL corresponding to the man killed. Thus one man could be killed by more than one round.

Initially LKILL is set to zero. At statement 490, IRN is referenced and if the random is less than LPKH, indicating a kill, the bit number, LBIT, to be turned on in LKILL is selected by randomization. The number of hits, IH, is decremented by one, statement 500, and if IH is not zero, control goes back to statement 490. If the random number, generated above, was not less than LPKH, control goes directly to statement 500. When IH is zero, LKILL is compared to zero. If equal to zero there were no kills, and control goes to statement 590. If not equal to zero the number of bits on in LKILL are counted in NCAS. NCAS is then set to minimum of NCAS, the number of weapons the firer has, and the number of weapons firer has a crew for. If NCAS then exceeds the current strength of the unit, it is set equal to the current strength. NCAS is then subtracted from the current strength, KMAN(ITNO) and added to the total casualties, KTCAS. If the current strength is now greater than zero control goes to statement 520, if equal to zero to statement 560.

Statement 530 starts processing frag ammo against infantry. The targets posture: pinned down, partially neutralized direct fire, partially neutralized indirect fire, not neutralized (1, 2, 3, 4), is stored in JPOS. The net cover of the target square is stored in LCOV2 from array LCOV2A. The index for obtaining probability of kill given a hit on infantry by fragmentation ammunition, LPKH, is computed as follows: neutralized (#4), INDEX = 3, 2, 1 for net cover = 3, 2, 1; or INDEX = 6, 5, 4 for not neutralized (=4) and net cover = 3, 2, 1.

At statement 535, the current men in the target unit is stored in KMAN1 (which serves as a counter) and JMEN.

At statement 540, if the random number is less than LPKH (indicating a kill), control goes to 580, the current strength is decremented by one, and the casualties, KTCAS, incremented by one. The current strength is then checked against the crew required to service the main weapon, ITKREW. If not enough men are remaining to service the main weapon, the current strength KMAN(ITNO) is decreased, and KTAS increased, by ITKREW.

If the current strength is now zero control goes to statement 560. Vehicle casualties, KVCAS, is increased by the current number of vehicles in the unit, KVEH(ITNO), and KVEH(ITNO) is set to zero. Subroutine DEAD is called and control goes to statement 590.

If the current strength is not zero, control goes to statement 550. The counter, KMAN1, is decremented by one, and if not equal to zero, control goes to statement 540. If equal to zero, the number of hits, IH, is decremented by one. If IH is not zero, control goes to statement 535. If IH is zero and the current strength, KMAN(ITNO) not equal to zero, control goes to statement 570, where JMEN (the initial strength) is compared with KMAN(ITNO). If they are equal, indicating no losses, control goes to statement 590. If not equal, the current strength is stored in KMAN1, KILWPN is called (statement 520) before going to 590.

This section, fragmentation ammunition on infantry, processes each hit against each man still alive in the target unit. If there is a kill, the current strength and counter are decremented. This continues until the number of hits is exhausted. If at any time the strength is not sufficient to man the unit's main weapon, the unit is killed. Exit from this section is always to statement 590.

At statement 590 the coordinates of the corner of the area are stored in IMPX1, 2 and IMPY1, 2. If the length and width of the impact area are equal, the direction, IMPDIR is set equal to zero.

The DO 610 loop checks for all targets in the impact area. Enemy units dead, mounted, or not the target if direct fire are not checked. The coordinates of the enemy unit being processed are stored in IXT and IYT. If the area is diagonal, control goes to statement 600 to pack the coordinates and check if the enemy unit is in the area. If the area is not diagonal the end points are checked. In any case if an enemy unit is in the area, control goes to statement 620.

At statement 602, if the weapon is artillery (JSWCH equal to zero), control goes to statement 680. The neutralization weight of indirect fire rounds received this impact is added in the array LLRA1; control then goes to statement 711. If the weapon was not artillery (JSWCH equal to one), the neutralization weight of direct fire rounds received this impact is added to the array LLRD1. The weapons of the enemy units in the impact area receiving direct fire are checked to determine if any have targets (DO 630). If none of the units weapons has a target, control goes to 610. If a weapon has a target and is not moving, or if moving and has firing "kind 3, 6, or 7" (statements 632, 634, and 636), and a weapon is available, its code and clock are set to "target select" and current time plus one. LOWCLK is called (statement 655), and control goes to 610. If the unit is moving and orders do not permit firing while moving, control goes to 610.

At statement 711, if the fire was direct fire, control goes to 610, if indirect fire to statement 712. If the weapon was not the main weapon, control goes to 610. If it was the main weapon and the target is dead, control goes to 610, if the target is not dead, control goes to 722.

Statement 722 is reached to process target in the impact area receiving indirect fire. If the target is infantry, control goes to statement 724, if not infantry, to statement 521.

At statement 724, JPOS, LCOV2, and INDEX are set to obtain the probability of kill given a hit, LPKIH, from array LPKIHA. JPOS and INDEX are set the same as at statement 530. The current strength of the target, KMAN(ITG) is stored in KMAN1, and the number of casualties, NCAS, set to zero. At statement 730, if the random number is less than LPKIH, NCAS and total casualties (KTCAS) are incremented, and at statement 740, the counter KMAN1 is decremented. If the random number is not less than LPKIH, control goes directly to statement 740. If KMAN1 is greater than zero, control goes back to 730. If KMAN1 is equal to zero, all men in the unit have been processed, KMAN(ITG) is decreased by NCAS and a check is made to determine if the target was a soft vehicle. If not a soft target, control goes to statement 742. If the target was a soft vehicle and the current strength is insufficient to operate the main weapon, the vehicle and men strength is set to zero, and the total vehicle and men casualties accumulated in NCAS and KVCAS. Control then passes to statement 742 and if KMAN(ITG) is greater than zero goes to statement 750. If KMAN(ITG) is zero, the number of vehicles, KVEH(ITG) is set to zero, subroutine DEAD is called, and control goes to statement 760. Above, if the current strength is sufficient to man the main weapon, control goes to statement 750.

At statement 521, non-infantry targets in the impact area receiving indirect fire are processed. Logical variable NLOG is set FALSE. In case a troop carrier is killed, routing will go into the direct fire section to set up dismounting, NLOG is used to control routing back to this section. If there are no vehicles in the target unit, control goes to 610. At statement 523, the number of current vehicles in the unit KVEH(ITG) is stored in JVEH and KVEH1. The number of current men per vehicle is stored in KMPV(ITG), the vulnerability class in LCV, the probability of kill given a hit in LPKH. At statement 524, a four-digit random number is computed and stored in IRNA. If IRNA is less than LPKH, indicating a kill, control goes to statement 532. If IRNA is not less than LPKH, control passes to statement 525 where the counter, KVEH1, is decremented. If KVEH1 is equal to zero, the current number of vehicles, KVEH(ITG) is compared to zero. If equal to zero, subroutine DEAD is called (statement 526), and control goes to statement 760. If not equal to zero, control goes to statement 527. Here JVEH is compared with the current vehicles, KVEH(ITG), if equal, control goes to statement 760, if unequal, the current number of men in the unit, KMAN(ITG) is stored in KMAN1 before going to 760.

Statement 532 is reached if a vehicle was killed. If it was not a troop carrier, control goes to 528, current vehicles, KVEH(ITG) is decremented and vehicle casualties, KVCAS, incremented by one. The current men, KMAN(ITG) is decreased by the number of men per vehicle, and casualties, KTCAS, increased by that amount. At statement 531 if NLOG is TRUE ITNO is restored, and if KVEH(ITG) is equal to zero, control goes to statement 526, if not to 525.

If the vehicle killed was a troop carrier, control goes to statement 529. NLOG is set TRUE, ITNO (it may have been previously set) is saved in ITNO1, and ITG is stored in ITNO. Control then goes to statement 390. This is the direct fire section to process troop survival in a carrier and dismount the unit if necessary. If there were no troop carrier survivors, control does not return to this section but goes directly to 760. If there were survivors, control returns to this section at statement 531.

At statement 760 the history message for IMPACT(TARGET) for area fire is stored, and control goes to statement 610.

After exit from the DO 610 loop, control goes to statement 770.

Direction, Width, and Length of Impact Area. Input is from Form Weapon 1. The DØ 680 loop of subroutine PACKER in the first preprocessor divides each by the grid size. If either quotient is greater than one, the width (or length) is set equal to three, if the quotient is not greater than one, the width (or length) is set equal to one. These are then packed into JWEAP as the length and width to be used.

In the IMPACT subroutine, the direction, width, and length are extracted from JWEAP into IMPDIR, IMPN1, and IMPN2, respectively (Statement 40). The coordinates of the center of impact are stored in IMPX and IMPY, and are stored packed in IMPKK2. If the length is equal to the width or the direction equal to one, control goes to statement 2000. If the direction is greater than one control goes to statement 80.

If the direction is equal to zero, IMPN1 (width) is set equal to zero and IMPN2 (length) is set equal to one and control goes to 2000.

At statement 80, if the direction is 2, X and Y, the center of impact (in IMPKK2) are both decreased by one and stored (packed) in IMPKK1, and increased by one and stored in IMPKK3. If the direction is 3, both are increased by one in IMPKK1 and decreased by one in IMPKK3. Control then passes to statement 2000.

The area of impact is processed beginning with statement 590. IMPX1, IMPX2, IMPY1, and IMPY2 are computed equal to the coordinates of the center of impact minus and plus the width and length of the impact area. If the length and width are equal the direction is set equal to zero.

If the direction is 2 or 3, the coordinates of the unit being processed are packed into ITGXY. If the unit is located at the coordinates in IMPKK1, 2, or 3 control goes to statement 620 for further processing of that unit.

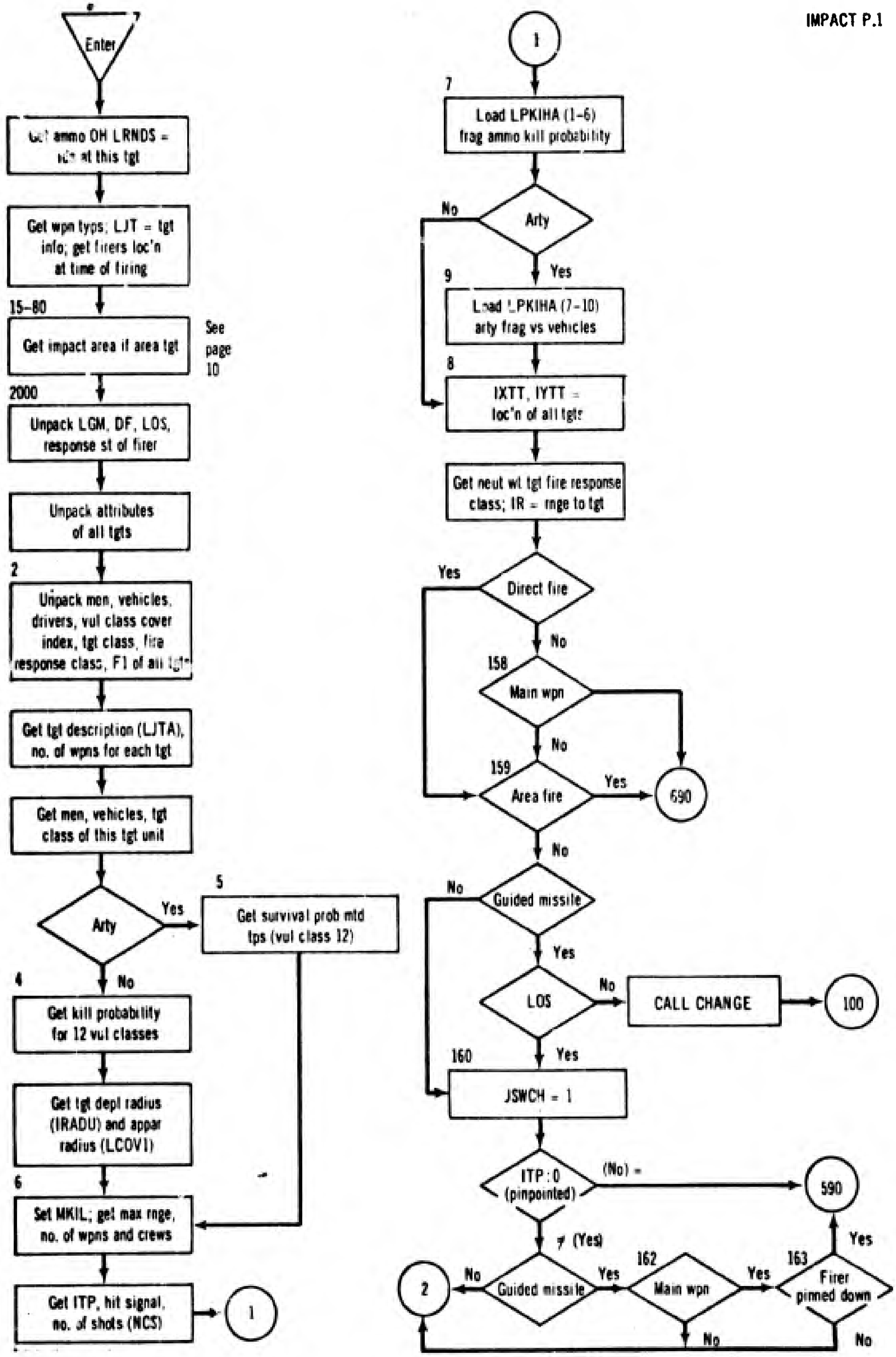
If the direction is 0 or 1, the targets location, IXT and IYT are checked to determine if it is within IMPX1— IMPX2 and IMPY1— IMPY2. If the target is in this area control goes to 620 for further processing.

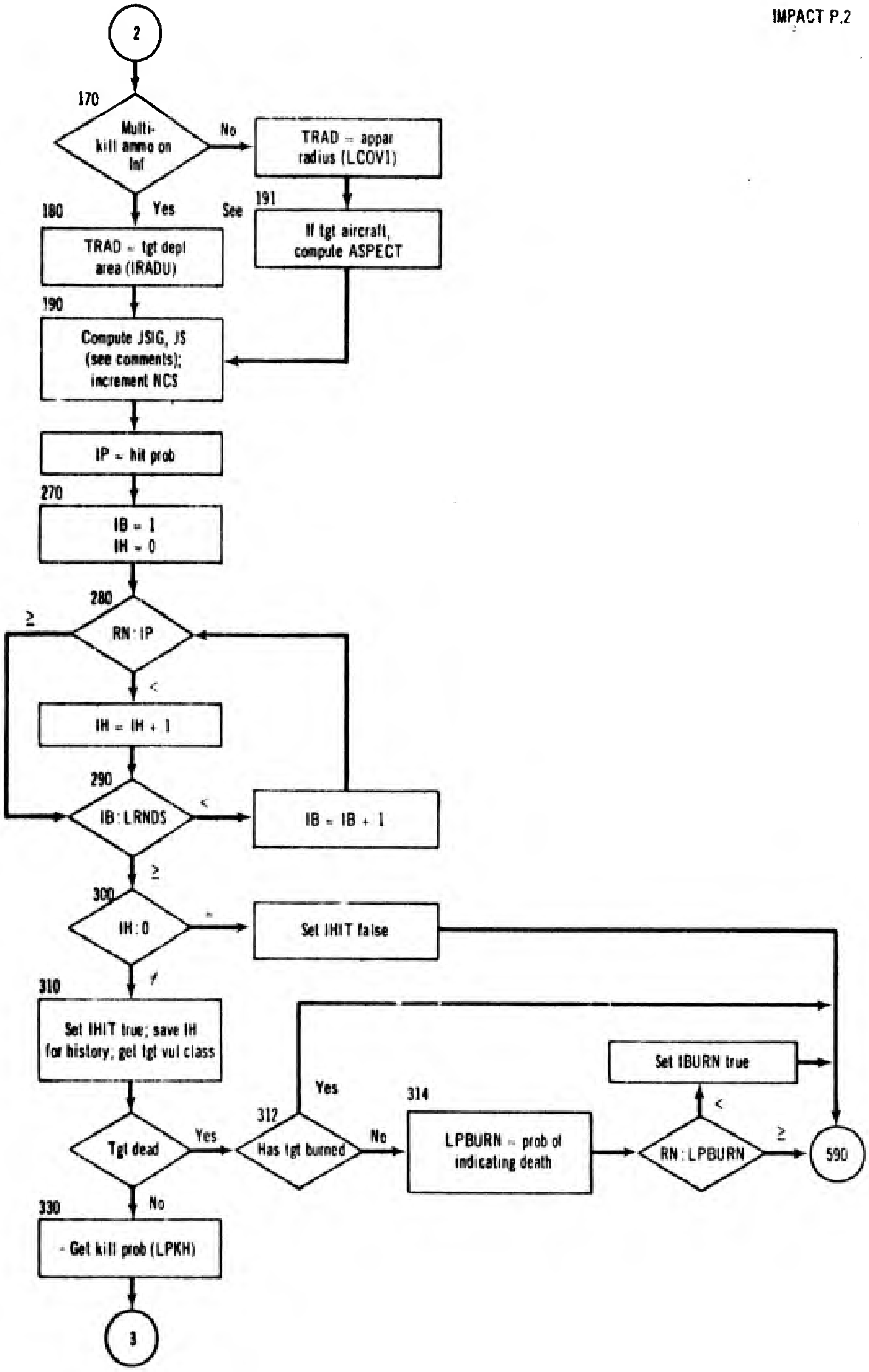
Thus, if the width equals the length, both as adjusted in the preprocessor, and they are not equal to zero the area will be 3 × 3 regardless of direction.

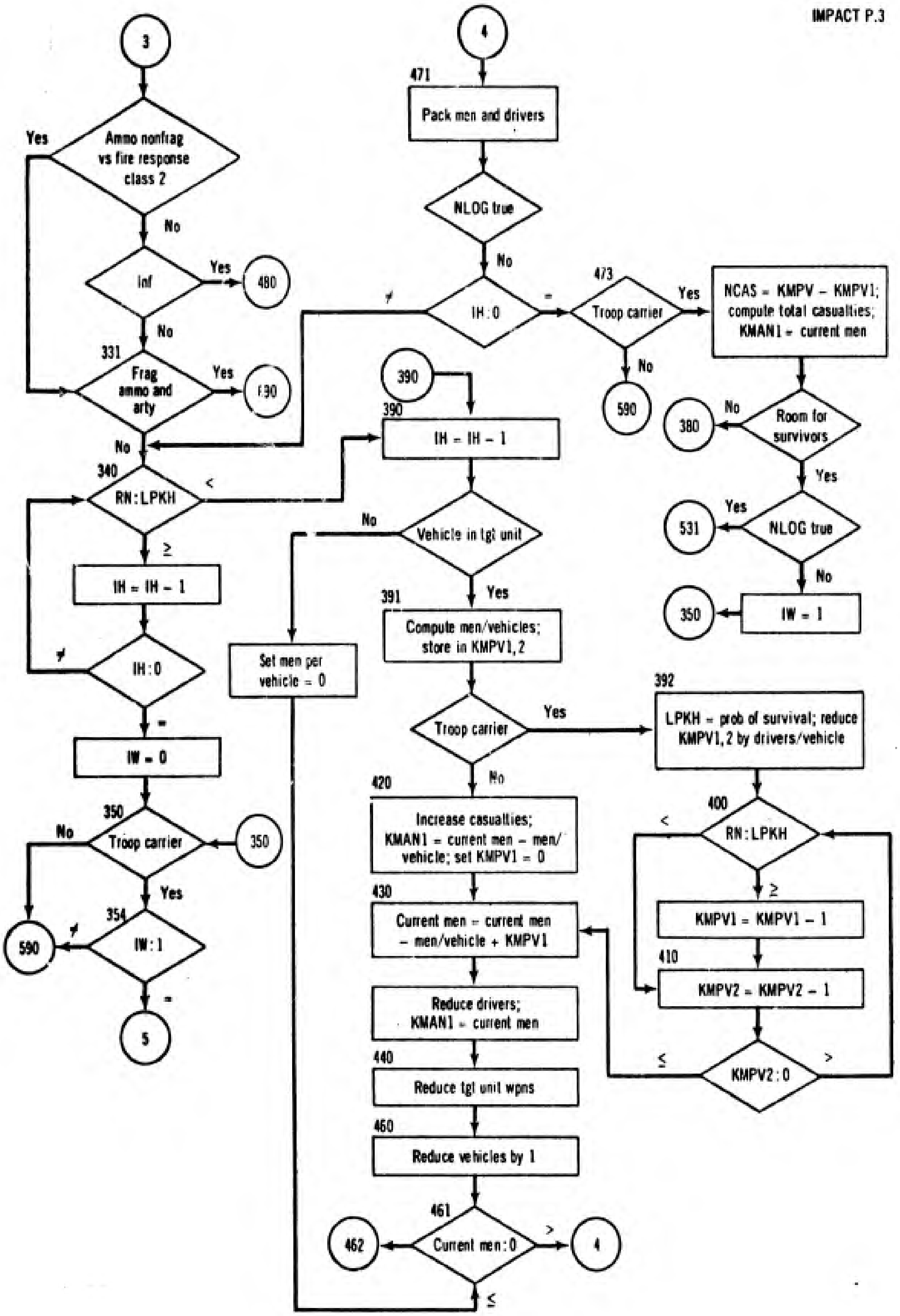
Direction equal to zero will always give a 1 × 3 area perpendicular to the X-axis.

Direction equal to one and width greater than length will give a 1 × 3 area paralled to the X-axis. Length greater than width will be the same as direction zero.

Direction 2 or 3 will give a 1 × 3 area inclined to the X-axis. Direction 2 - 45(225) degrees, direction 3 - 135(315) degrees.

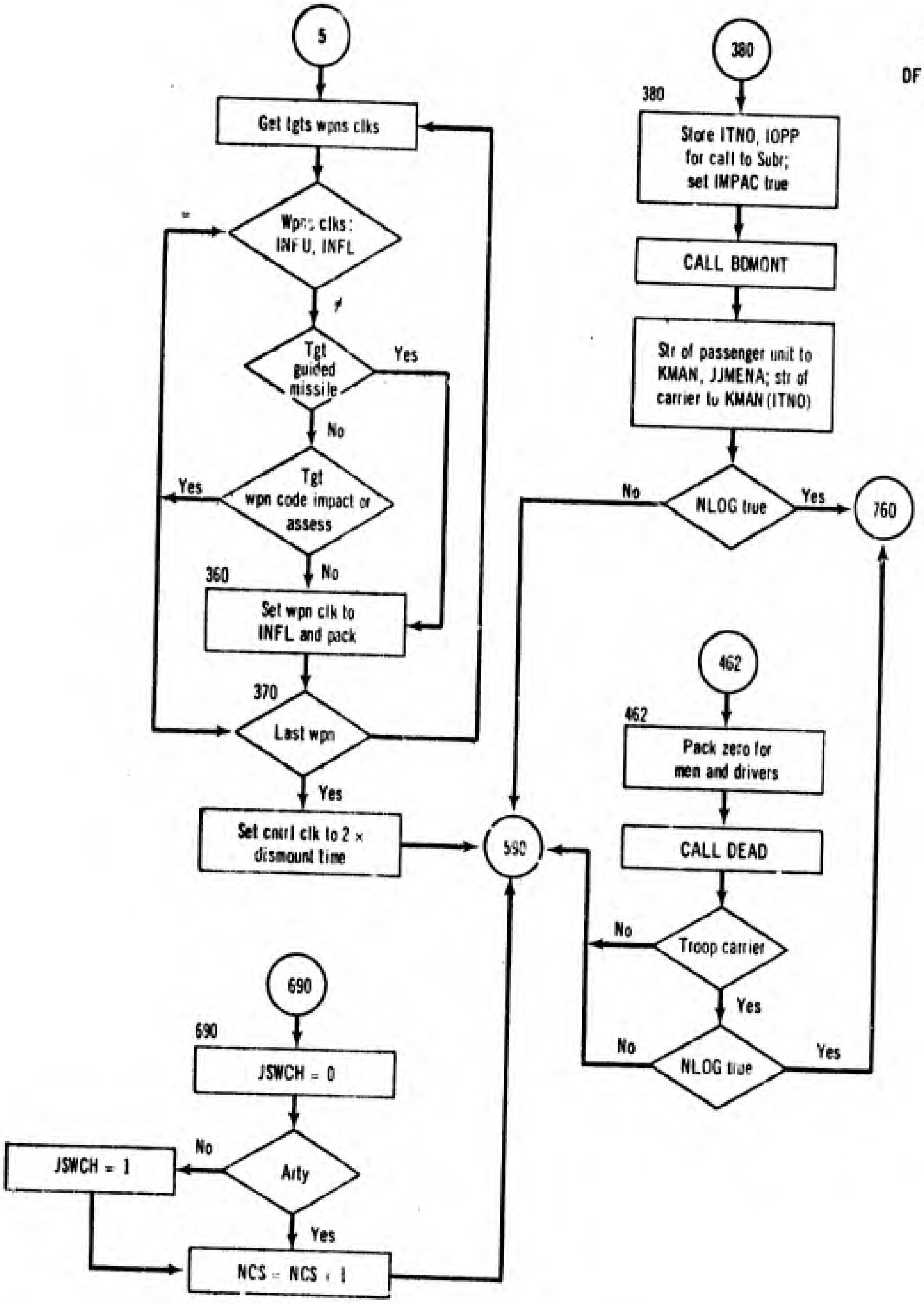

Enter
Get ammo OH LRNDS = rds at this tgt
Get wpn typs; LJT = tgt info; get firers loc'n at time of firing
15–80
Get impact area if area tgt
See page 10
2000
Unpack LGM, DF, LOS, response st of firer
Unpack attributes of all tgts
2
Unpack men, vehicles, drivers, vul class cover index, tgt class, fire response class, FI of all tgts
Get tgt description (LJTA), no. of wpns for each tgt
Get men, vehicles, tgt class of this tgt unit
Arty
Yes
5
Get survival prob mtd tps (vul class 12)
4
No
Get kill probability for 12 vul classes
Get tgt depl radius (IRADU) and appar radius (LCOVI)
6
Set MKIL; get max rnge, no. of wpns and crews
Get ITP, hit signal, no. of shots (NCS)
1
1
7
Load LPKIHA (1-6) frag ammo kill probability
No
Arty
9
Yes
Load LPKIHA (7-10) arty frag vs vehicles
8
IXTT, IYTT = loc'n of all tgts
Get neut wt tgt fire response class; IR = rnge to tgt
Yes
Direct fire
No
158
Main wpn
No
159
Area fire
Yes
690
No
No
Guided missile
Yes
LOS
No
CALL CHANGE
100
160
Yes
JSWCH = 1
ITP : 0 (pinpointed)
(No) =
590
≠ (Yes)
2
No
Guided missile
Yes
162
Main wpn
Yes
163
Firer pinned down
Yes
No
No


2
170
Multi-kill ammo on Inf
No
TRAD = appar radius (LCOV1)
180
Yes
See
191
If tgt aircraft, compute ASPECT
TRAD = tgt depl area (IRADU)
190
Compute JSIG, JS (see comments); increment NCS
IP = hit prob
270
IB = 1
IH = 0
280
≥
RN : IP
<
IH = IH + 1
290
IB : LRNDS
<
IB = IB + 1
≥
300
IH : 0
=
Set IHIT false
310
≠
Set IHIT true; save IH for history, get tgt vul class
Yes
314
Set IBURN true
<
312
Tgt dead
Yes
Has tgt burned
No
LPBURN = prob of indicating death
RN : LPBURN
≥
590
330
No
Get kill prob (LPKH)
3

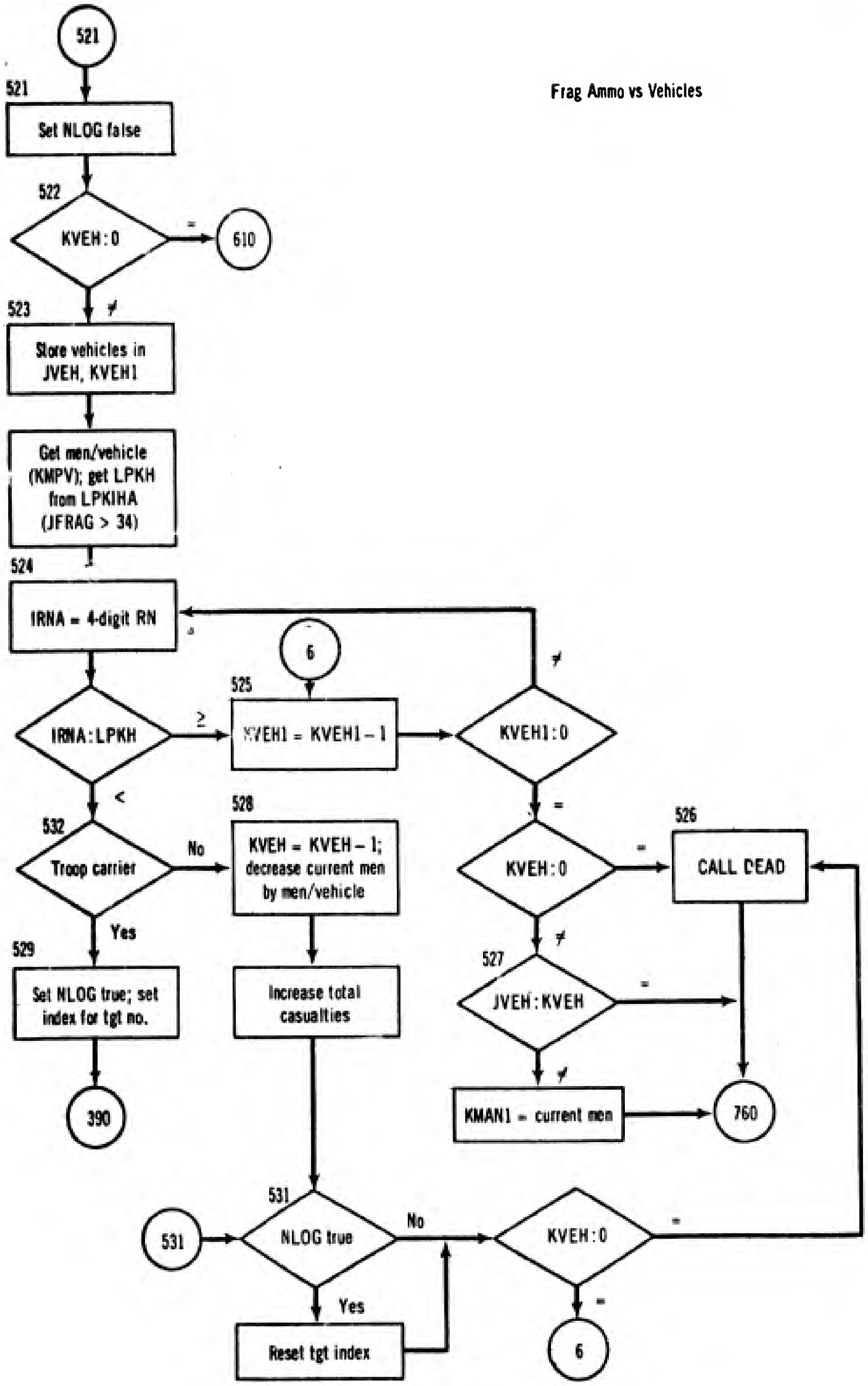

3
Ammo nonfrag vs fire response class 2
Yes
No
Inf
Yes
480
No
331
Frag ammo and arty
Yes
530
No
340
RN:LPKH
<
≥
IH = IH − 1
IH:0
≠
=
IW = 0
350
Troop carrier
No
350
Yes
354
IW:1
≠
590
=
5
4
471
Pack men and drivers
NLOG true
No
IH:0
≠
=
473
Troop carrier
Yes
No
590
NCAS = KMPV − KMPV1; compute total casualties; KMAN1 = current men
Room for survivors
No
380
Yes
NLOG true
Yes
531
No
IW = 1
350
390
390
IH = IH − 1
Vehicle in tgt unit
No
Set men per vehicle = 0
Yes
391
Compute men/vehicles; store in KMPV1,2
Troop carrier
Yes
392
LPKH = prob of survival; reduce KMPV1,2 by drivers/vehicle
No
420
Increase casualties; KMAN1 = current men − men/vehicle; set KMPV1 = 0
400
RN:LPKH
<
≥
KMPV1 = KMPV1 − 1
410
KMPV2 = KMPV2 − 1
KMPV2:0
≤
>
430
Current men = current men − men/vehicle + KMPV1
Reduce drivers; KMAN1 = current men
440
Reduce tgt unit wpns
460
Reduce vehicles by 1
461
Current men:0
462
>
4
≤

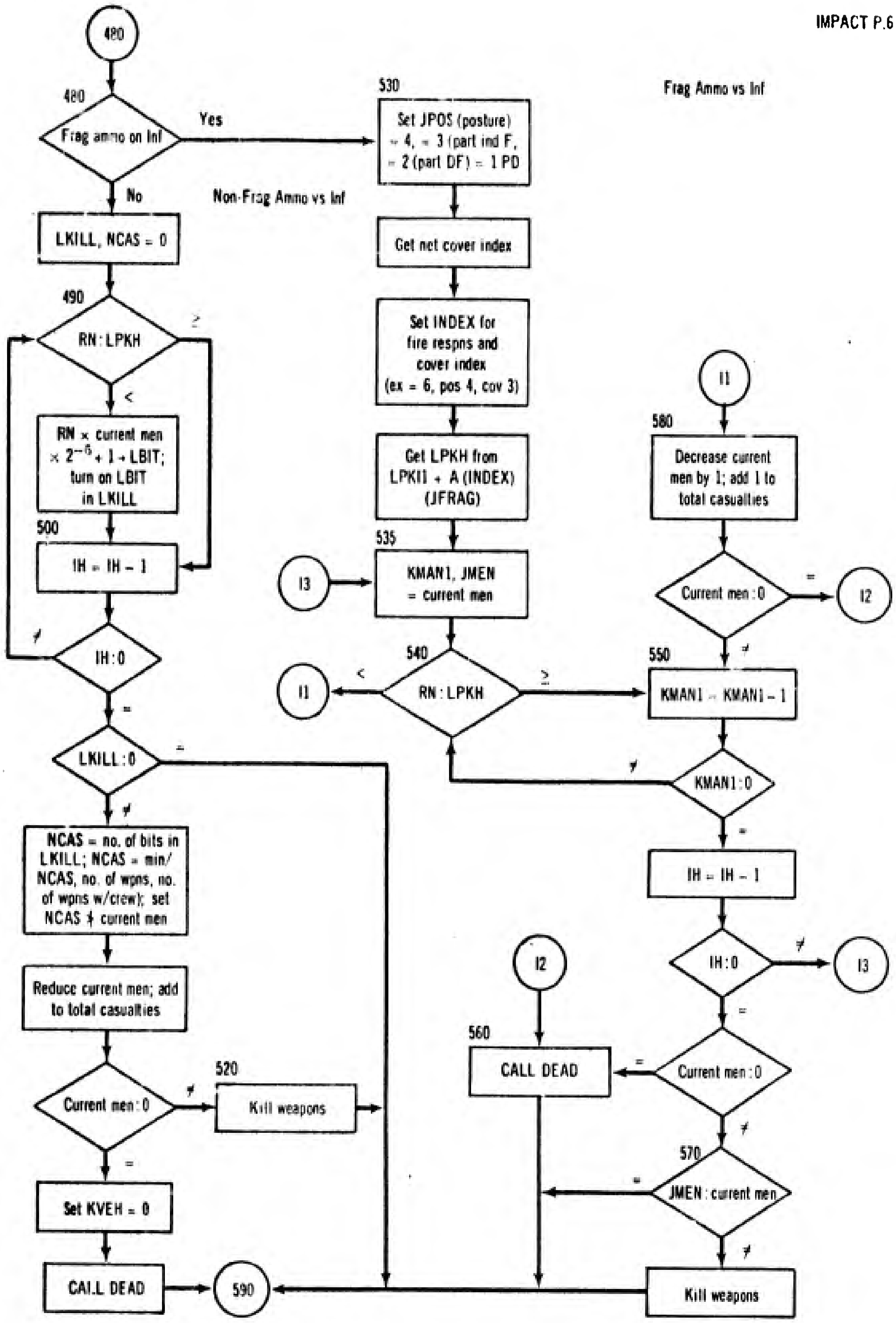
IMPACT P.4

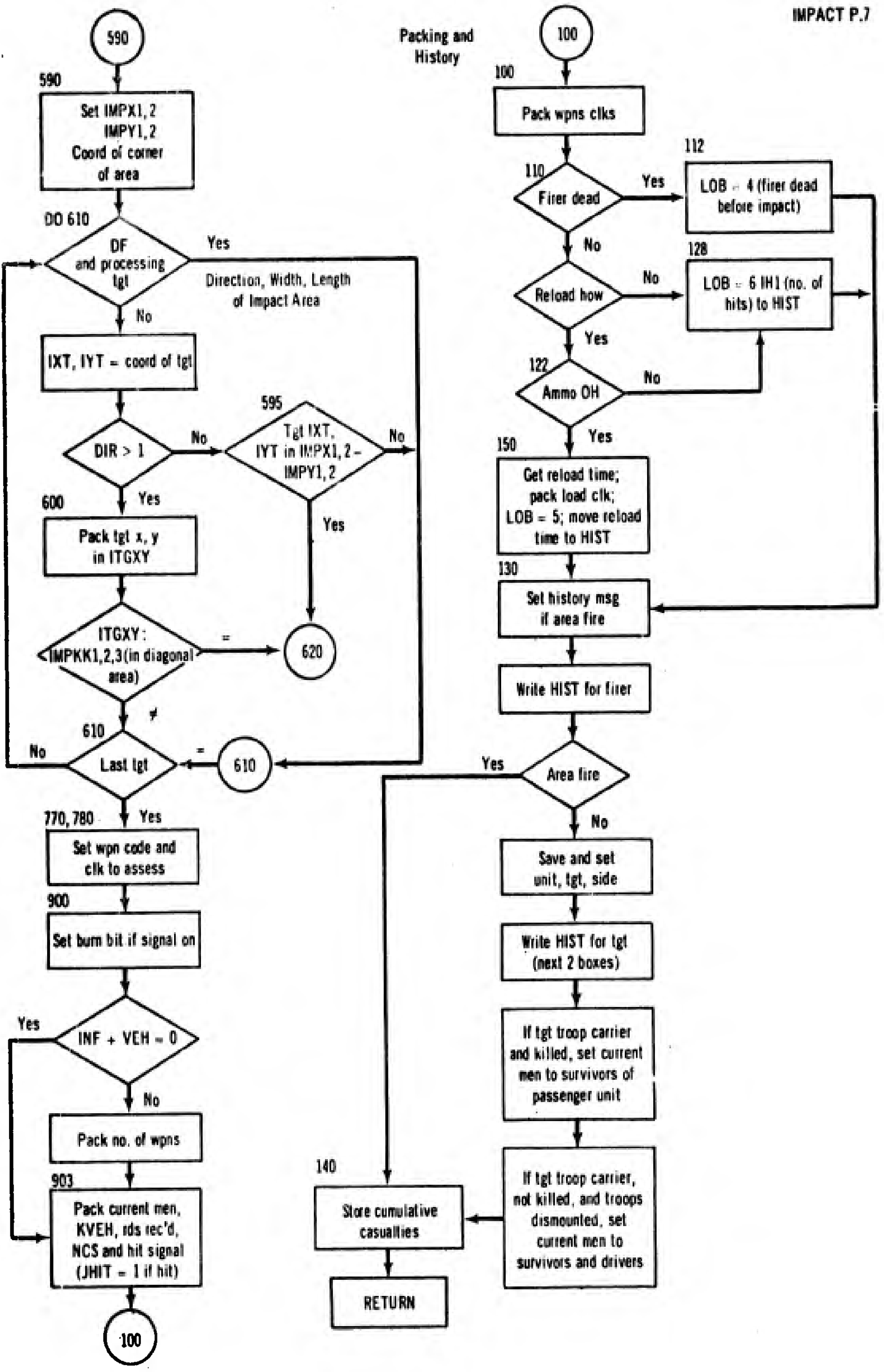
DF vs Vehicles

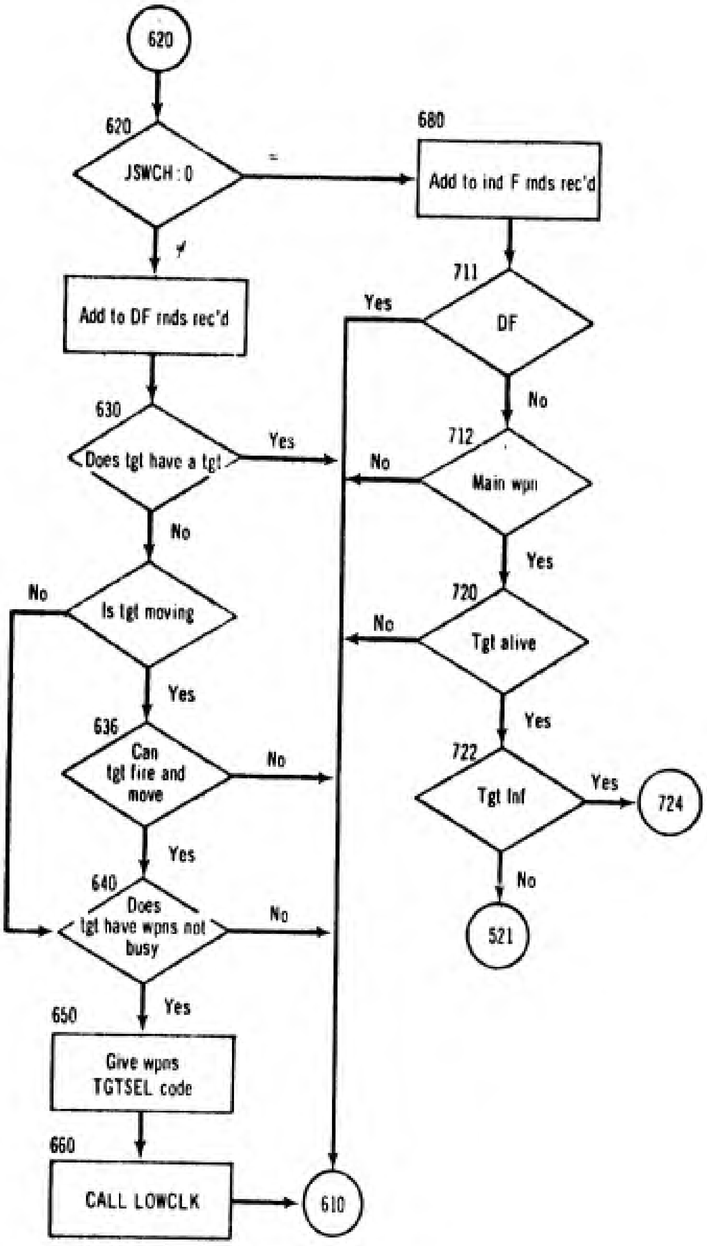

5
Get tgts wpns clks
Wpns clks: INFU, INFL
Tgt guided missile
Yes
No
Tgt wpn code impact or assess
Yes
No
360
Set wpn clk to INFL and pack
370
Last wpn
Yes
Set cntrl clk to 2 × dismount time
590
380
380
Store ITNO, IOPP for call to Subr; set IMPAC true
CALL BDMONT
Str of passenger unit to KMAN, JJMENA; str of carrier to KMAN (ITNO)
No
NLOG true
Yes
760
462
462
Pack zero for men and drivers
CALL DEAD
No
Troop carrier
Yes
No
NLOG true
Yes
690
690
JSWCH = 0
No
Arty
JSWCH = 1
Yes
NCS = NCS + 1

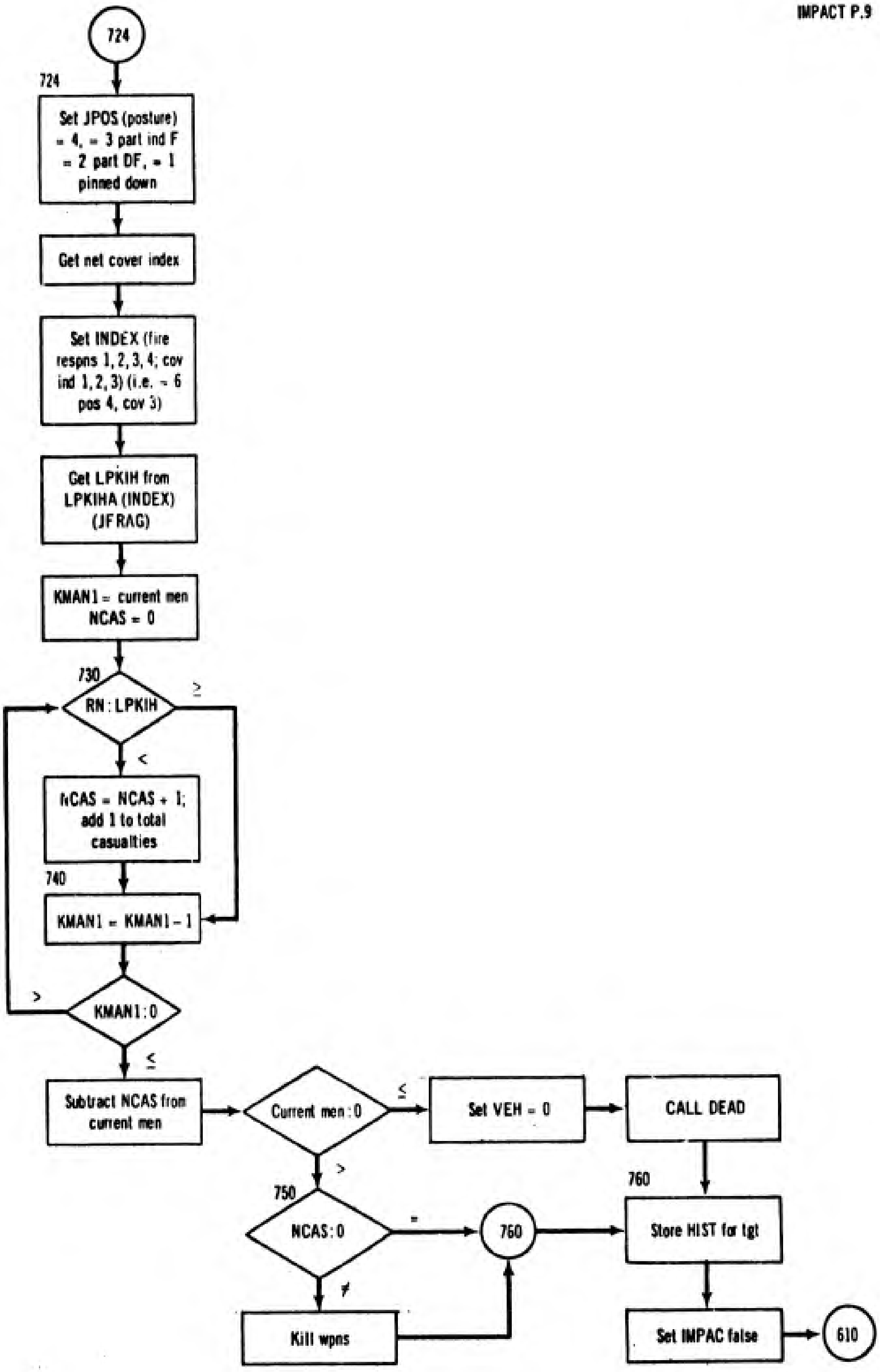
Frag Ammo vs Vehicles

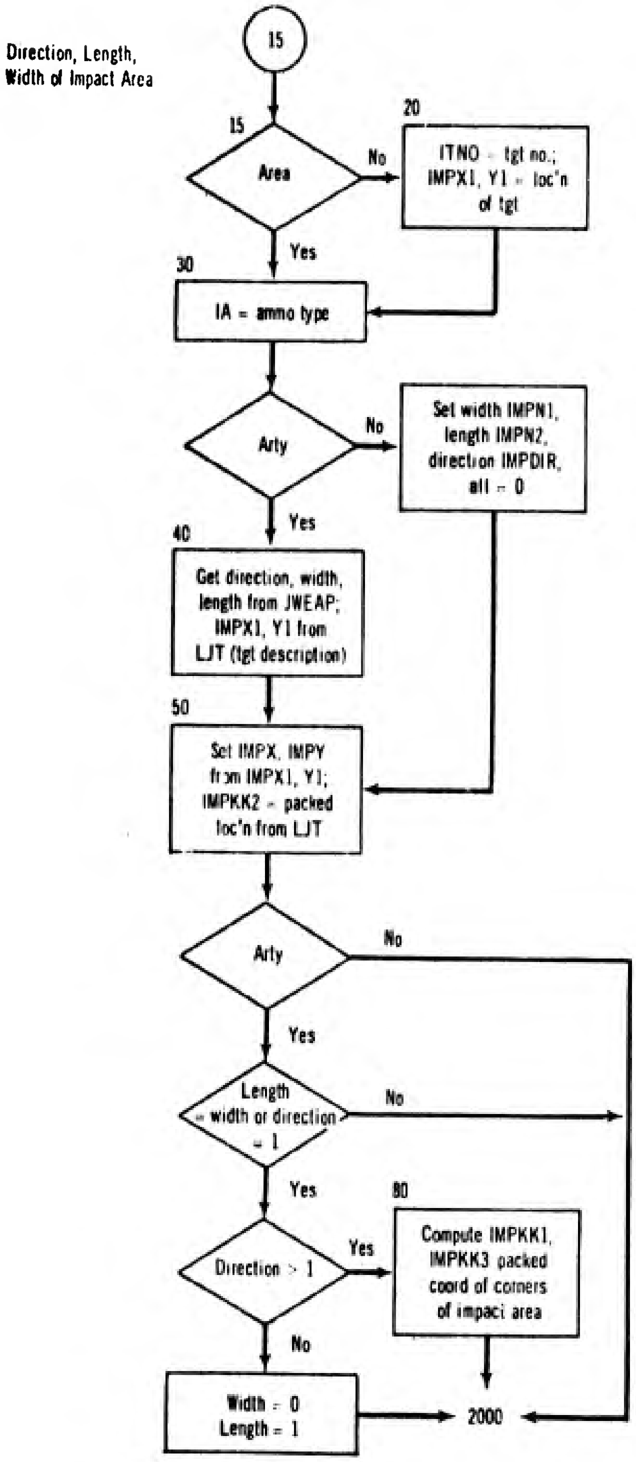

521
521
Set NLOG false
522
KVEH : 0
=
610
523
≠
Store vehicles in JVEH, KVEH1
Get men/vehicle (KMPV); get LPKH from LPKIHA (JFRAG > 34)
524
IRNA = 4-digit RN
6
≠
IRNA : LPKH
≥
525
KVEH1 = KVEH1 – 1
KVEH1 : 0
<
=
532
Troop carrier
No
528
KVEH = KVEH – 1; decrease current men by men/vehicle
KVEH : 0
=
526
CALL DEAD
Yes
529
Set NLOG true; set index for tgt no.
Increase total casualties
≠
527
JVEH : KVEH
=
≠
390
KMAN1 = current men
760
531
531
NLOG true
No
KVEH : 0
=
Yes
≠
Reset tgt index
6

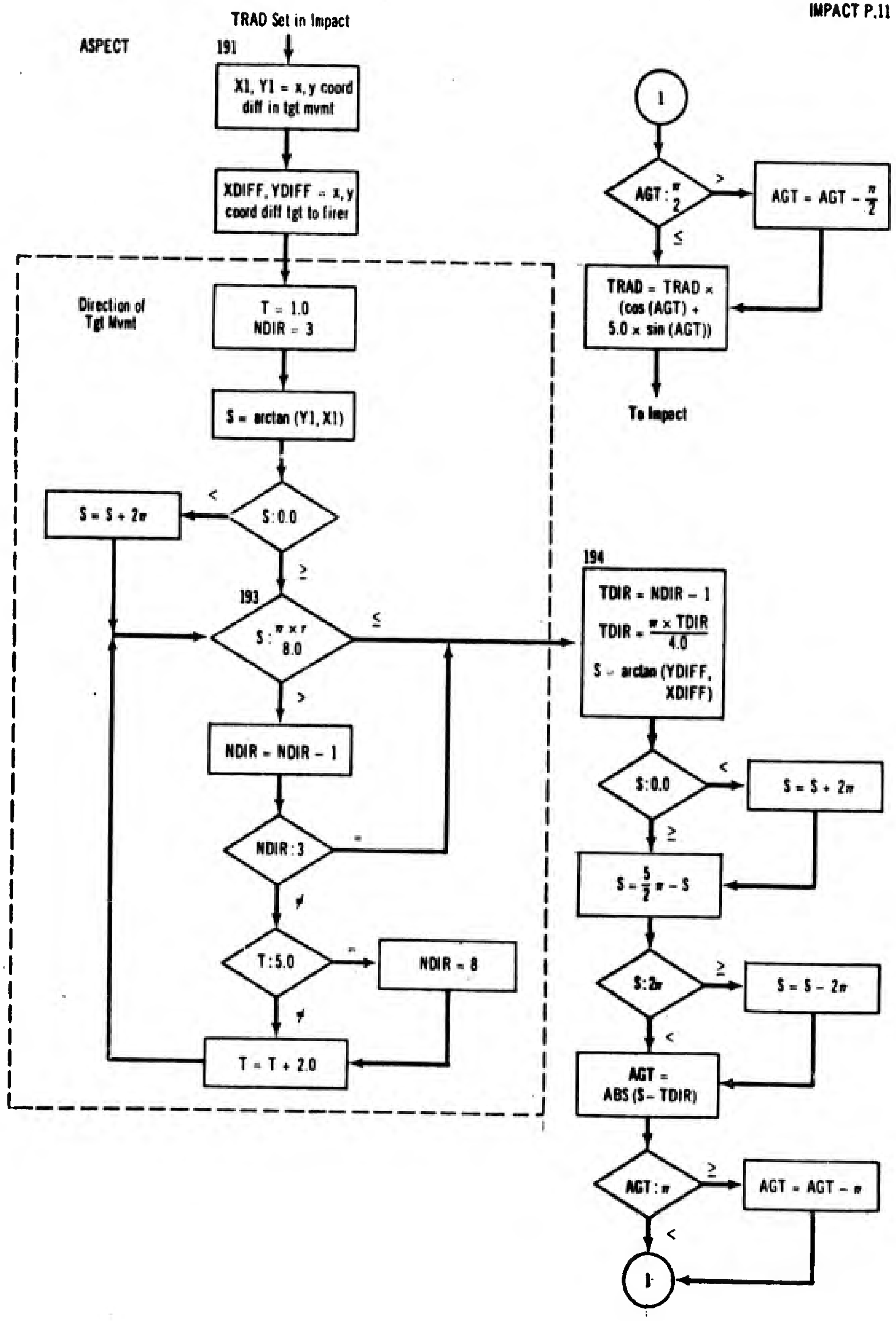

480
480
Frag ammo on Inf
Yes
No
Non-Frag Ammo vs Inf
Frag Ammo vs Inf
LKILL, NCAS = 0
490
RN : LPKH
≥
<
RN × current men × 2^-6 + 1 → LBIT; turn on LBIT in LKILL
500
IH = IH − 1
≠
IH : 0
=
LKILL : 0
=
≠
NCAS = no. of bits in LKILL; NCAS = min/ NCAS, no. of wpns, no. of wpns w/crew); set NCAS ≯ current men
Reduce current men; add to total casualties
Current men : 0
≠
=
520
Kill weapons
Set KVEH = 0
CALL DEAD
590
530
Set JPOS (posture) = 4, = 3 (part ind F, = 2 (part DF) = 1 PD
Get net cover index
Set INDEX for fire respns and cover index (ex = 6, pos 4, cov 3)
Get LPKH from LPKI1 + A (INDEX) (JFRAG)
535
I3
KMAN1, JMEN = current men
540
I1
<
RN : LPKH
≥
550
KMAN1 = KMAN1 − 1
≠
KMAN1 : 0
=
IH = IH − 1
IH : 0
≠
I3
=
I2
560
CALL DEAD
=
Current men : 0
≠
570
=
JMEN : current men
≠
Kill weapons
I1
580
Decrease current men by 1; add 1 to total casualties
Current men : 0
=
I2
≠


590
590
Set IMPX1, 2 IMPY1, 2 Coord of corner of area
DO 610
DF and processing tgt
Yes
Direction, Width, Length of Impact Area
No
IXT, IYT = coord of tgt
595
DIR > 1
No
Tgt IXT, IYT in IMPX1, 2 - IMPY1, 2
No
600
Yes
Yes
Pack tgt x, y in ITGXY
ITGXY: IMPKK1,2,3 (in diagonal area)
=
620
≠
610
No
Last tgt
=
610
770, 780
Yes
Set wpn code and clk to assess
900
Set burn bit if signal on
Yes
INF + VEH = 0
No
Pack no. of wpns
903
Pack current men, KVEH, rds rec'd, NCS and hit signal (JHIT = 1 if hit)
100
Packing and History
100
100
Pack wpns clks
112
110
Firer dead
Yes
LOB = 4 (firer dead before impact)
No
128
Reload how
No
LOB = 6 IH1 (no. of hits) to HIST
Yes
122
Ammo OH
No
150
Yes
Get reload time; pack load clk; LOB = 5; move reload time to HIST
130
Set history msg if area fire
Write HIST for firer
Yes
Area fire
No
Save and set unit, tgt, side
Write HIST for tgt (next 2 boxes)
If tgt troop carrier and killed, set current men to survivors of passenger unit
140
Store cumulative casualties
If tgt troop carrier, not killed, and troops dismounted, set current men to survivors and drivers
RETURN


620
620
JSWCH : 0
=
≠
680
Add to ind F rnds rec'd
Add to DF rnds rec'd
711
DF
Yes
No
630
Does tgt have a tgt
Yes
712
Main wpn
No
No
Yes
No
Is tgt moving
No
720
Tgt alive
No
Yes
Yes
636
Can tgt fire and move
No
722
Tgt Inf
Yes
724
Yes
No
640
Does tgt have wpns not busy
No
521
Yes
650
Give wpns TGTSEL code
660
CALL LOWCLK
610


724
724
Set JPOS (posture) = 4, = 3 part ind F = 2 part DF, = 1 pinned down
Get net cover index
Set INDEX (fire respns 1, 2, 3, 4; cov ind 1, 2, 3) (i.e. = 6 pos 4, cov 3)
Get LPKIH from LPKIHA (INDEX) (JFRAG)
KMAN1 = current men NCAS = 0
730
RN : LPKIH
≥
<
NCAS = NCAS + 1; add 1 to total casualties
740
KMAN1 = KMAN1 − 1
>
KMAN1 : 0
≤
Subtract NCAS from current men
Current men : 0
≤
Set VEH = 0
CALL DEAD
>
750
NCAS : 0
=
760
760
Store HIST for tgt
≠
Kill wpns
Set IMPAC false
610


15
Direction, Length,
Width of Impact Area
15
Area
No
20
ITNO = tgt no.;
IMPX1, Y1 = loc'n
of tgt
Yes
30
IA = ammo type
Arty
No
Set width IMPN1,
length IMPN2,
direction IMPDIR,
all = 0
Yes
40
Get direction, width,
length from JWEAP;
IMPX1, Y1 from
LJT (tgt description)
50
Set IMPX, IMPY
from IMPX1, Y1;
IMPKK2 = packed
loc'n from LJT
Arty
No
Yes
Length
= width or direction
= 1
No
Yes
80
Direction > 1
Yes
Compute IMPKK1,
IMPKK3 packed
coord of corners
of impact area
No
Width = 0
Length = 1
2000


ASPECT
TRAD Set in Impact
191
X1, Y1 = x, y coord diff in tgt mvmt
XDIFF, YDIFF = x, y coord diff tgt to firer
Direction of Tgt Mvmt
T = 1.0
NDIR = 3
S = arctan (Y1, X1)
S : 0.0
<
S = S + 2π
≥
193
S : π × r / 8.0
≤
>
NDIR = NDIR − 1
NDIR : 3
=
≠
T : 5.0
=
NDIR = 8
≠
T = T + 2.0
194
TDIR = NDIR − 1
TDIR = π × TDIR / 4.0
S = arctan (YDIFF, XDIFF)
S : 0.0
<
S = S + 2π
≥
S = 5/2 π − S
S : 2π
≥
S = S − 2π
<
AGT = ABS (S − TDIR)
AGT : π
≥
AGT = AGT − π
<
1
1
AGT : π/2
>
AGT = AGT − π/2
≤
TRAD = TRAD × (cos (AGT) + 5.0 × sin (AGT))
To Impact

IRANGE

Purpose: To compute the range from seeker to target unit.

Arguments: IX1, IY1, IZ1, IX2, IY2, IZ2 (Coordinates and altitudes of seeker and target units)

Called by: CLARTY, CLHCPR, DESTGT, DGFRST, FIRING, IMADET, IMPACT, NEWMIS, OPFRST, POSDIS, PRORTG, STOP1, TACTIC, TGTACQ, TGTSEL.

Computes the hypotenuse of the right triangle whose sides are the absolute values of the difference between the X and Y coordinates of the locations of the two units. The altitude is not used.

Function IRN

Purpose: To generate a Random Number

Arguments: N (dummy index return variable for random number)
Labeled common MAIN, CNTRL.

Called by: CLARTY, CLHCPR, DESTGT, DGFRST, FIRING, IMADET, IMPACT, NEWMIS, OPFRST, POSDIS, PRORTG, STOP1, TACTIC, TGTACQ, TGTSEL.

This function uses the last random number (NUMR in MAIN common) to compute a new random number. It stores 35 bits in NUMR and returns the left 6 bits.

ISEEU (Logical Function)

Purpose:	To return the logical function TRUE if the unit being processed has line of sight with the target unit.
Arguments:	IU (the unit being processed), IS (the side), IEN (the target) labeled common MAIN.
Called by:	FIRING, IMPACT, ASSESS.

JWORD is set to the unit being processed if the side is blue and to the target number if the side is red. NBIT is set to the target number if the side is blue and to the unit being processed if the side is red. If the NBIT bit of the JWORD word of JLOS is on, ISEEU is returned TRUE, otherwise FALSE.

KILWPN

Purpose: To reduce the number of main weapons in a unit which has casualties to the number which the unit has personnel to operate

Arguments: KS (strength of the target unit), ITG (target unit number), MWPT1 (firing weapon type), labeled common MAIN, CNTRL, HSTDAT.

Called by: IMPACT.

After one or more elements of a target unit have been killed the number of men firing the units weapons is reduced. Also, if the strength of the unit is not sufficient to man its main weapons, the number of main weapons is reduced accordingly. This subroutine is not necessary as TGTSEL, DESTGT, and FIRING assign available personnel to weapons. The history message is not printed.

KONCOV

Purpose: To determine the new cover and concealment values of an infantry unit when it moves into a new square or dismounts, according to the units response state: partially neutralized by direct fire or pinned down.

Arguments: KTRIG (=0, not suppressed, =1 pinned down, =2 partially suppressed by direct fire). Labeled common MAIN, CNTRL, TERRAN.

Called by: BOUNDX, RESPNS

Subroutine TERRA is called to get terrain data (cover and concealment indices) for the current square. The element size class is extracted from the second characteristics word into IRAD.

The DO 30 loops unpacks cover, concealment, and net cover from JCNVRT for the element size class of the unit being processed for all cover states (input from form TERRAIN 2) into arrays LCON1A, LCOV1A, and LCOV2A. If the unit is an aircraft, the loop is exited the first time through to statement 31 where it is given the lowest index (no cover or concealment), and control goes to statement 71 to pack JUCHAR and return to calling routine.

If the unit is not an aircraft, control goes to statement 33 after exiting the DO 30 loop. LCOV3 and LCON3 are set to the cover and concealment index extracted from TERRA plus KTRIG. Using these indices, the cover, concealment, and net cover are stored in LCON1, LCOV1, and LCOV2. Control then passes to statement 71.

NOTE: LCON1 is used in TGTACQ; LCOV1, apparent radius for hit in IMPACT; and LCOV2, net cover, in IMPACT.

Logical Function LOS

Purpose: To determine if line of sight exists between two squares.

Arguments: JXS, JYS, JHS, JXT, JYT, JHT (coordinates and altitude of seeker unit and target unit), labeled common MAIN, TERRAN.

Called by: FIRING, LSCHEK, LS2TG, TGTSEL.

This function checks each terrain square between seeker location and target location to determine if intervening elevation or vegetation prohibits line of sight. Statement 70 to 90 computes the coordinates of the intervening squares on the staircase. If line of sight exists the function is returned TRUE, otherwise FALSE.

LSCHEK

Purpose:	To determine if line of sight exists between the unit being processed and all units on the opposite side.
Arguments:	Labeled common MAIN, CNTRL.
Called by:	BDMONT, BMOUNT, BOUNDX, CHGVRT, MOVE, NEWMIS.

After unpacking the coordinates and altitude of all enemy units (DO 3), the LOS function is checked to determine if line of sight exists to each unit, setting the logical array LLOS (the DO 30 loop). The DO 60 loop calls SEEU and sets the appropriate bit ON or OFF in the eleventh control word of the enemy unit. The bit pattern for the unit being processed is then packed in its eleventh control word.

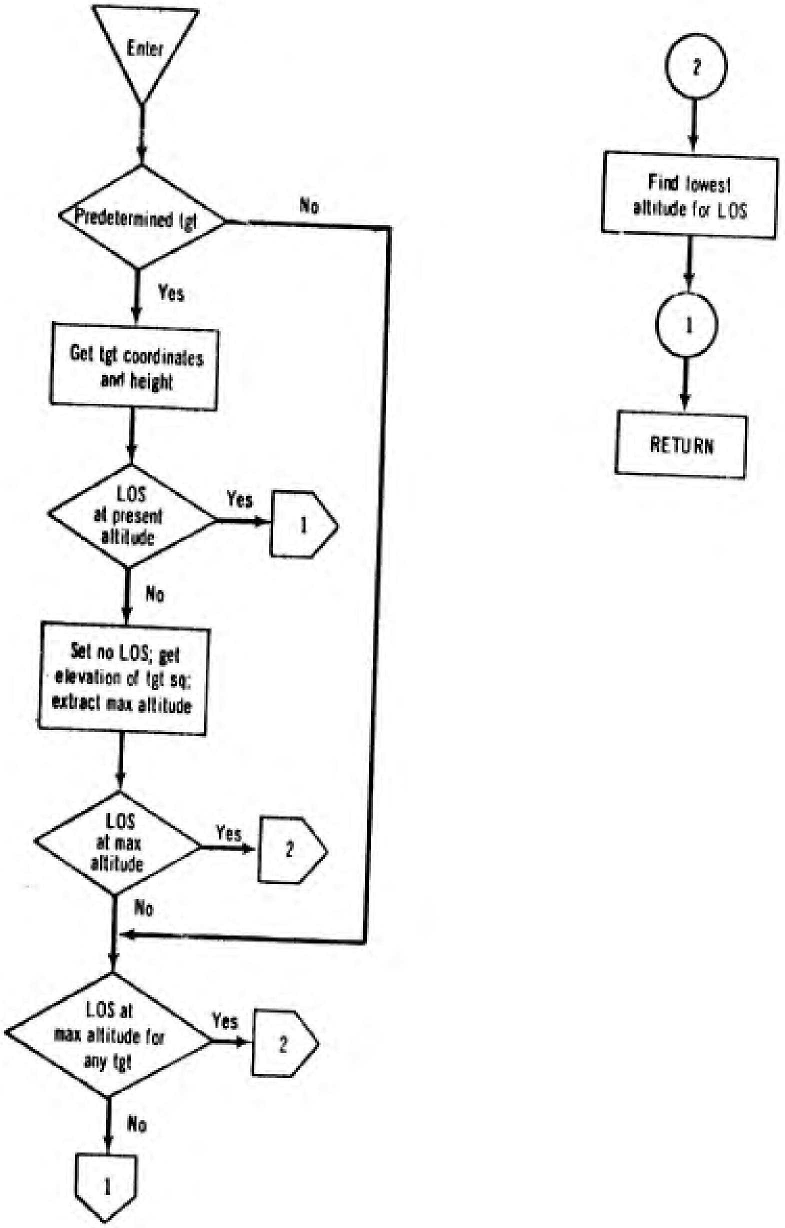
LS2TG

Purpose:	To establish the altitude necessary for an air unit to have line of sight to its target if called by a command unit, or to any target if not called. The altitude is stored in KAD. If no change of altitude is necessary, KAD is set equal to zero, if no line of sight at any altitude, KAD is set equal to minus one.
Arguments:	LCM, air units mobility class, ITNO, target number, KAD, labeled common MAIN.
Called by:	CHGVRT.

KAD is set to zero. If the unit has no targets, control goes to statement 70. All enemy units are checked to determine if line of sight exists to any unit from the helicopter unit's maximum altitude. If none exists, KAD is set equal to minus one, and control returns to calling routine. If line of sight to a unit does exist at maximum altitude control goes to statement 30. (This transfer to statement 30 is the first unit in LOS.) The altitude increment is stored in LDELAS, and KAD is set equal to current altitude plus LDELAS. If line of sight exists at this altitude, control returns to calling routine (statement 40). If not, control goes to statement 50, and KAD is incremented by LDELAS until line of sight exists before returning.

If the unit has a target, its coordinates are entered in IXT and IYT, and if not an area target, its altitude into IZT. At statement 20 if line of sight exists at present altitude, control returns to calling routine. If it does not exist, LOS is checked from maximum altitude; if it exists at maximum altitude, control goes to statement 30.

LS2TG


Enter
Predetermined tgt
No
Yes
Get tgt coordinates and height
LOS at present altitude
Yes
1
No
Set no LOS; get elevation of tgt sq; extract max altitude
LOS at max altitude
Yes
2
No
LOS at max altitude for any tgt
Yes
2
No
1
2
Find lowest altitude for LOS
1
RETURN

MOVAIR

Purpose: To determine the movement times for aircraft from center to boundary, ITCB, of current square, and boundary to center, ITBC, of the next square. Altitude of the movement is also determined.

Arguments: ITCB, ITBC, and labeled common MAIN.

Called by: MOVE.

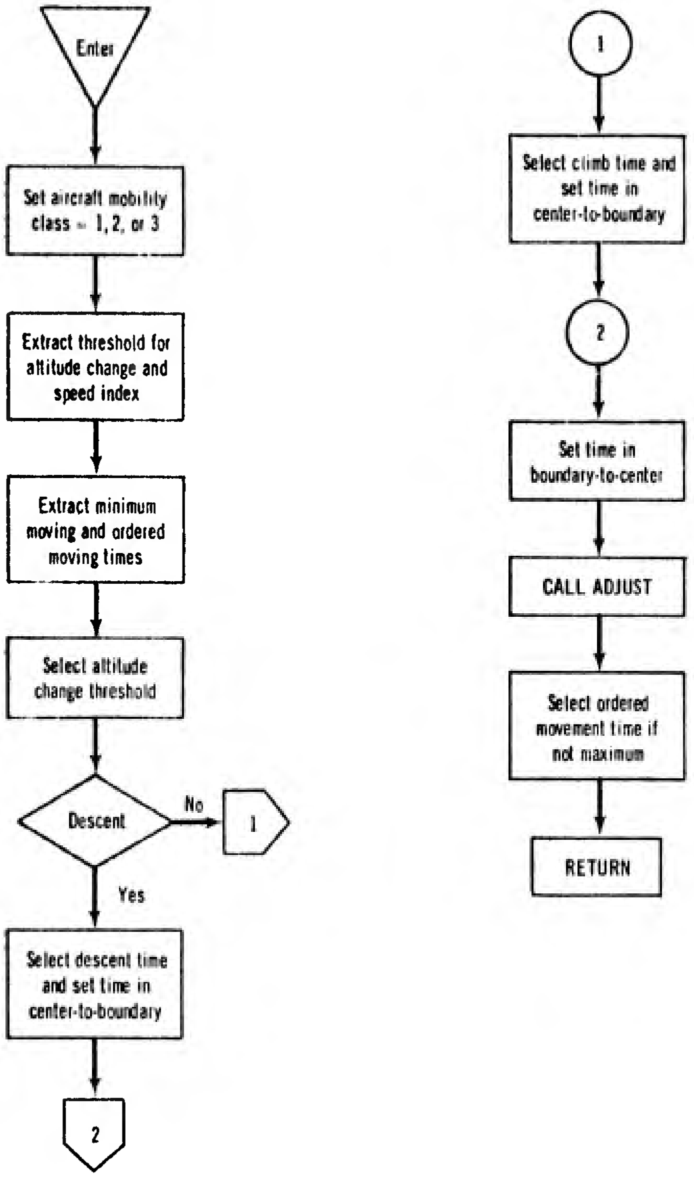
The mobility class of the unit being processed is stored in LCM; using this as the index, the descent and climb thresholds are extracted from JAMOB into LACTT, the minimum movement times for descent and climb from JAMOB into LMMTA, and the seven ordered movement times from JMISC into LOMTA.

The altitude change is extracted from JCNTRL into LAA (it was packed in JCNTRL in MOVE). If LAA is negative, control goes to statement 50 to use descent time thresholds in LACCT to obtain the index for LMMTA. This LMMTA is then stored in ITCB and ITBC. If LAA is positive, control goes to statement 60, and the climb time obtained, and similarly the time stored in ITCB and ITBC.

Subroutine ADJUST is then called, to adjust the movement times if necessary.

If the movement rate in the order is the maximum possible, control returns to the calling program. If not ITCB and ITBC are set to the smaller of ITBC and LOMTA before returning to calling program.

MOVAIR


Enter
Set aircraft mobility class = 1, 2, or 3
Extract threshold for altitude change and speed index
Extract minimum moving and ordered moving times
Select altitude change threshold
Descent
No
1
Yes
Select descent time and set time in center-to-boundary
2
1
Select climb time and set time in center-to-boundary
2
Set time in boundary-to-center
CALL ADJUST
Select ordered movement time if not maximum
RETURN

MOVE

Purpose:	Determines if the unit being processed is able to move, and if so determines the next square, time required to move, computes velocity, and sets the units weapons to "decision" if unit can move and fire and has not fired.
Arguments:	Labeled common MAIN, TREAT, TERRAN, CNTRL, HSTDAT.
Called by:	DECIDE.

First JATRIB and mission order word are unpacked. If kind of fire is 4 and the main weapon is aimed, control goes to statement 1000. At statement 3 the objective coordinates, terrain data for current square, target numbers of all weapons, cover index, mobility class, main weapon event code, and slope thresholds are unpacked. Ordered moving time for rates 0-6 are unpacked into LOMTG(DO 4). Moving probabilities, for mobility class of this unit and ordered move doctrine from mission word, are unpacked into LMVPRB (DO 5). At DO 6 the minimum movement times for road and cross-country conditions and slope are unpacked into LMMTG.

If the unit being processed is an aircraft and MWG is a "stay" order, control goes to statement 1000. If not a "stay" order and ordered altitude is one, control goes to statement 130. Otherwise the altitude above the ground (LITA) and level flight altitude (LARGA) are extracted from JAMOB before going to 130.

If unit is not an aircraft, control goes to statement 40. If pinned down or has "stay" order, control goes to statement 1000. If MWG is less than six (stops permitted), or unit is partially neutralized, or unit is unable to fire, or unit has been halted to fire or none of its weapons has a target, control goes to statement 130. Otherwise control goes to 110. If the main weapon requires guidance and is awaiting impact, control goes to statement 1000, otherwise to 112.

At statement 112 the index, L, for probability of moving, LMVPRB, is set depending on target for main or secondary weapon, and cover index.

If random number indicates no movement, control goes to statement 1000, if movement indicated, to 130.

At statement 130 the coordinates of the objective square are stored in IXT1 and IYT1. At 170 the direction to the objective is considered in computing the next square to move into; its coordinates are stored in NXTX and NXTY. The terrain data for this square is then extracted. If the unit is an aircraft, control goes to statement 211. If not an aircraft and the same road connects both squares, control goes to statement 270 after setting index for each square in IT and IT1. If no such road exists the cross-country trafficability index is entered in IT and IT1. The difference in elevation between the two squares is computed and compared with the slope thresholds to get the moving times from LMMTG. If the terrain is impassable, moving times are set to lower infinity. If the terrain is passable, times center to boundary and boundary to center are entered in ITCB and ITBC.

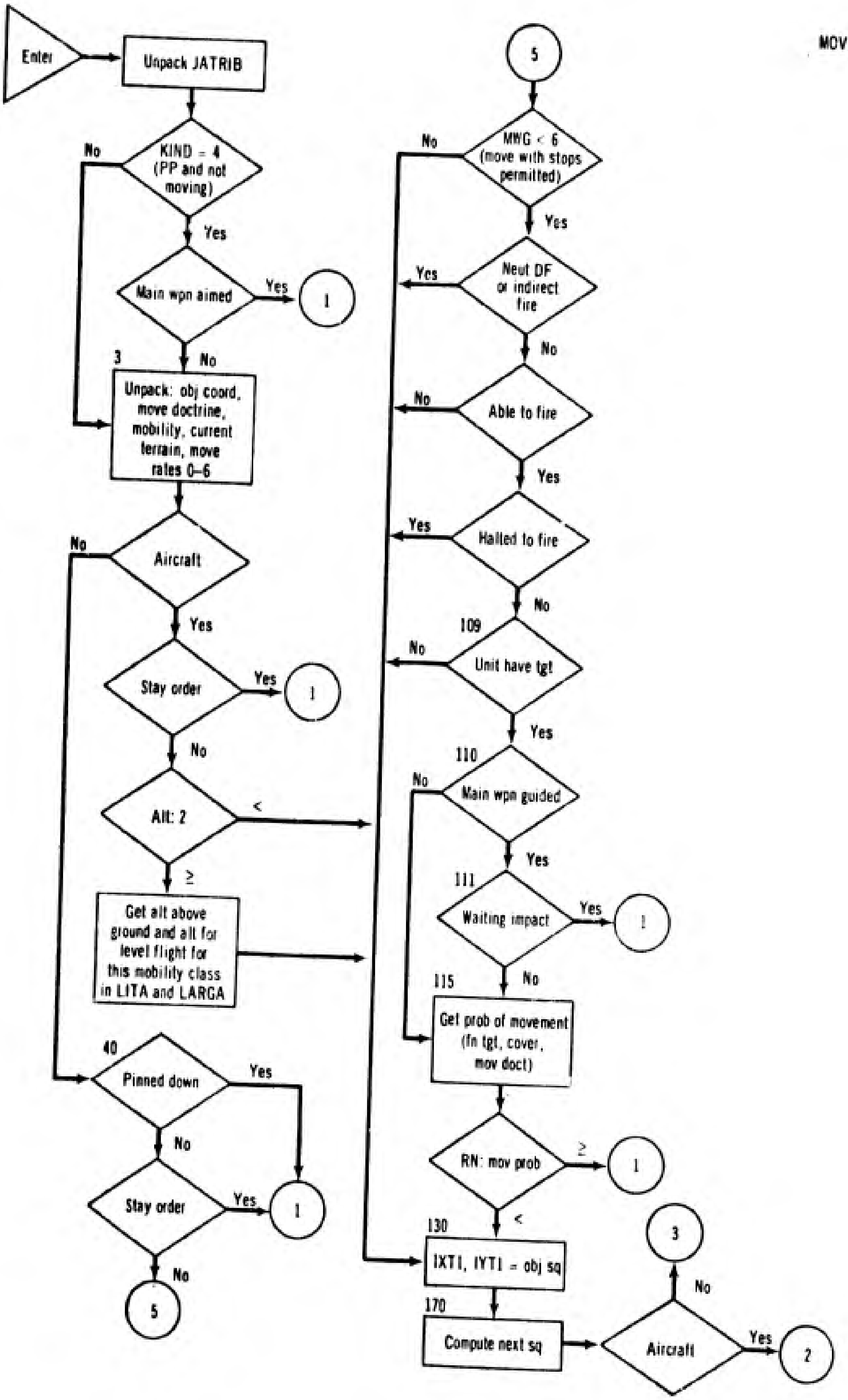
If the unit is partially neutralized by direct fire, moving ordered speed index is set to the lowest, and ITCB, ITBC are reset from LOMTG. If not neutralized, or neutralized by indirect fire only, no adjustment is made. If ordered movement speed is the maximum, no change is made. Then statement 300, if the move is diagonal the times are adjusted by multiplying by square root of two, and control goes to statement 310, for packing.

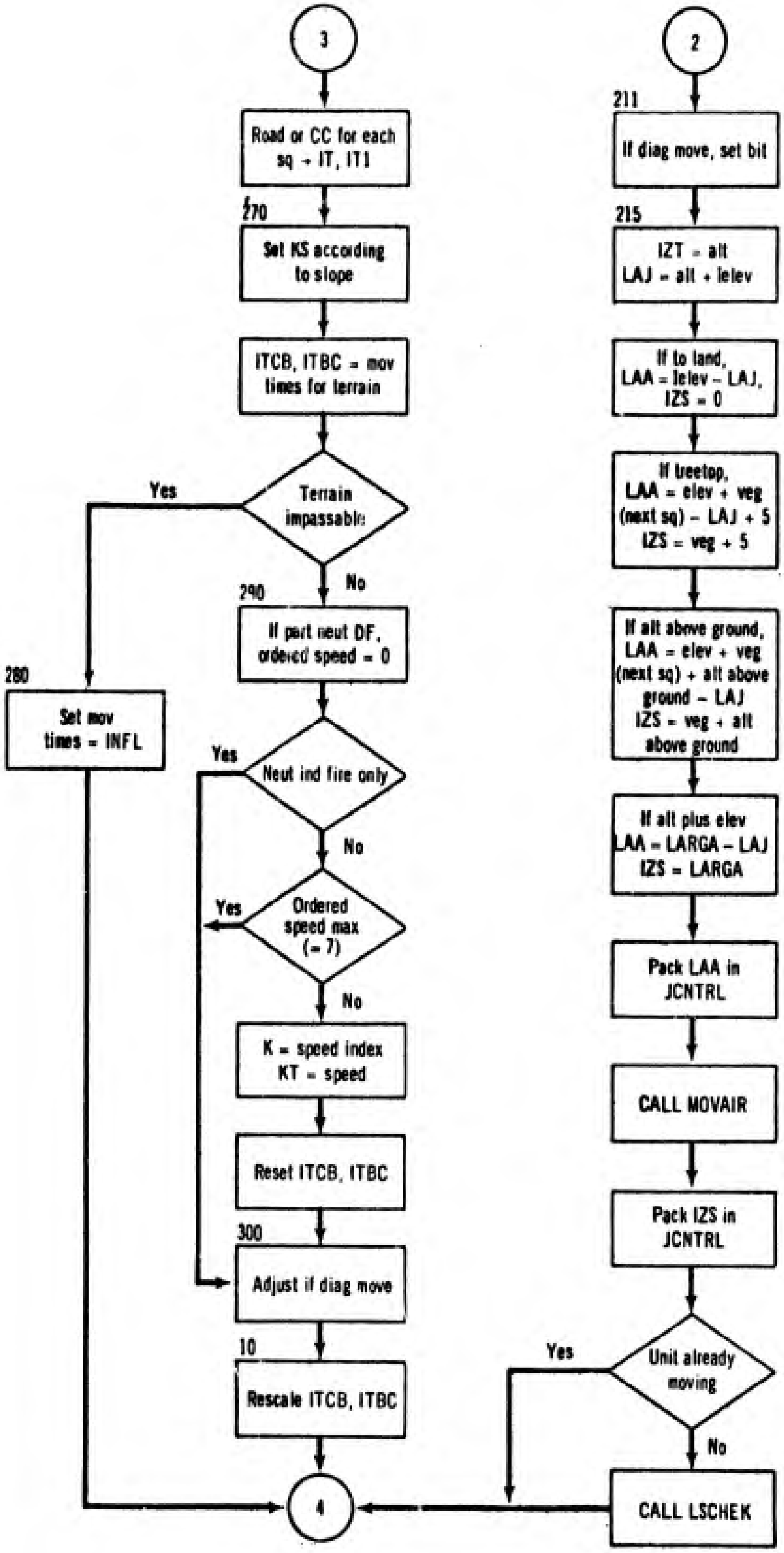
At statement 1000 (the unit is not to move), the move bit it turned OFF at JATRIB, and control clock and code set to current time plus decision cycle and "decision," and control is returned to the calling routine.

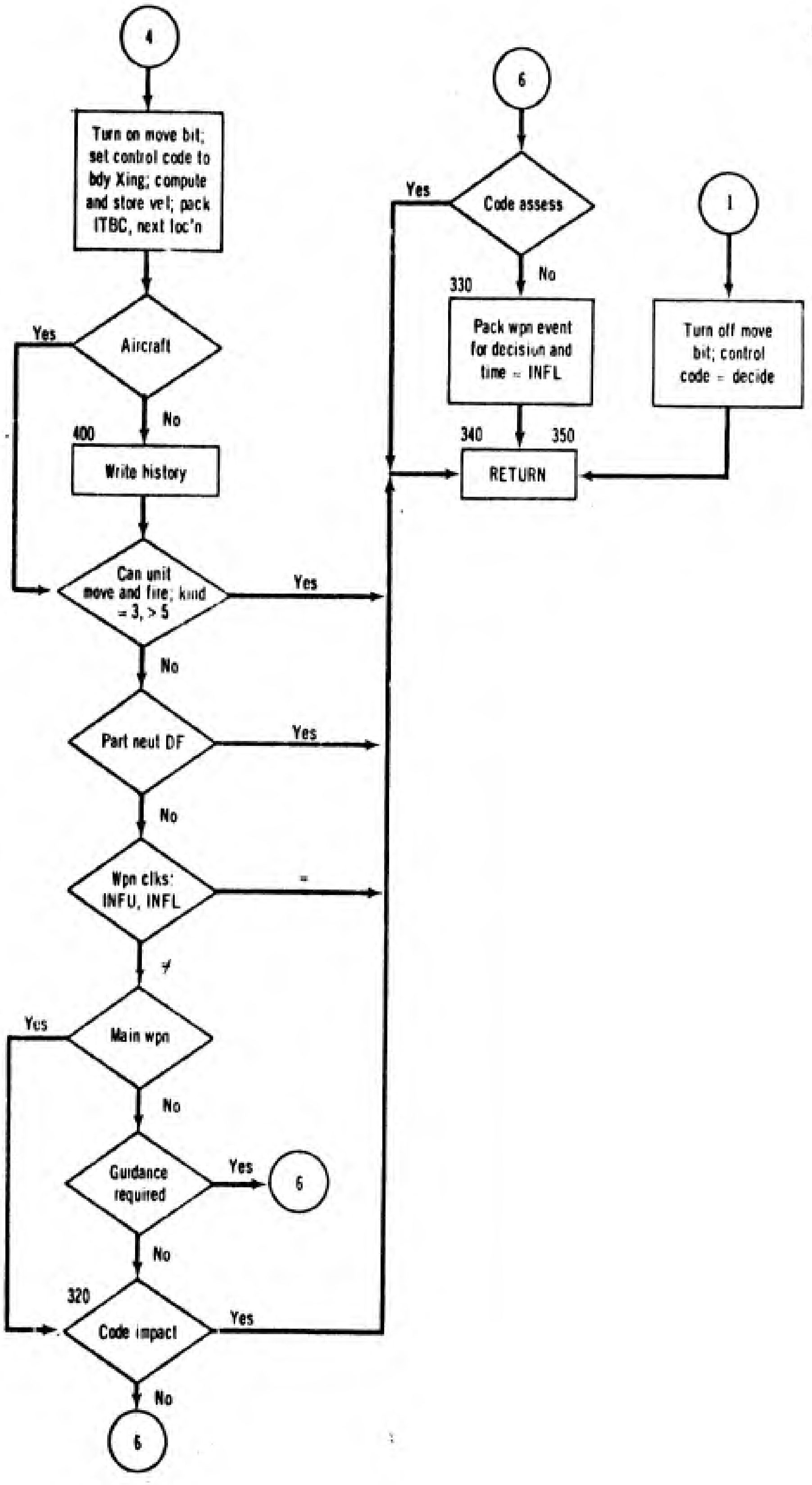
After statement 200 if the unit was an aircraft, control went to 211. If the move is diagonal the diagonal bit is turned ON in JATRIB. At 215, LAJ is set equal to altitude plus elevation. If the unit is to land the altitude is set to zero. If the mission is treetop, LAA is set to elevation plus vegetation height minus LAJ plus 5 feet. Altitude is set to 5 feet above vegetation. If the order is altitude above ground, LAA is equated to elevation plus LITA plus vegetation minus LAJ, and altitude to LITA plus vegetation. If the order is altitude plus elevation LAA is equated to LARGA minus altitude plus(or minus) elevation difference and altitude set to LARGA. Then LAA (the computed altitude change is packed into JCNTRL). Subroutine MOVAIR is called to compute ITCB and ITBC, and altitude packed in JCNTRL. If the air unit was not moving when this subroutine was entered LSCHEK is called.

At statement 310, packing is processed for both air and ground units that move. The move bit in JATRIB is turned ON, the velocity is computed for printing and is stored in JATRIB, the control clock is set equal to current time plus ITCB, ITBC is stored in JCNTRL word one, the control code is set to "boundary crossing," and next X and Y coordinates are packed in JCNTRL. If the unit is not an aircraft, the history message is stored.

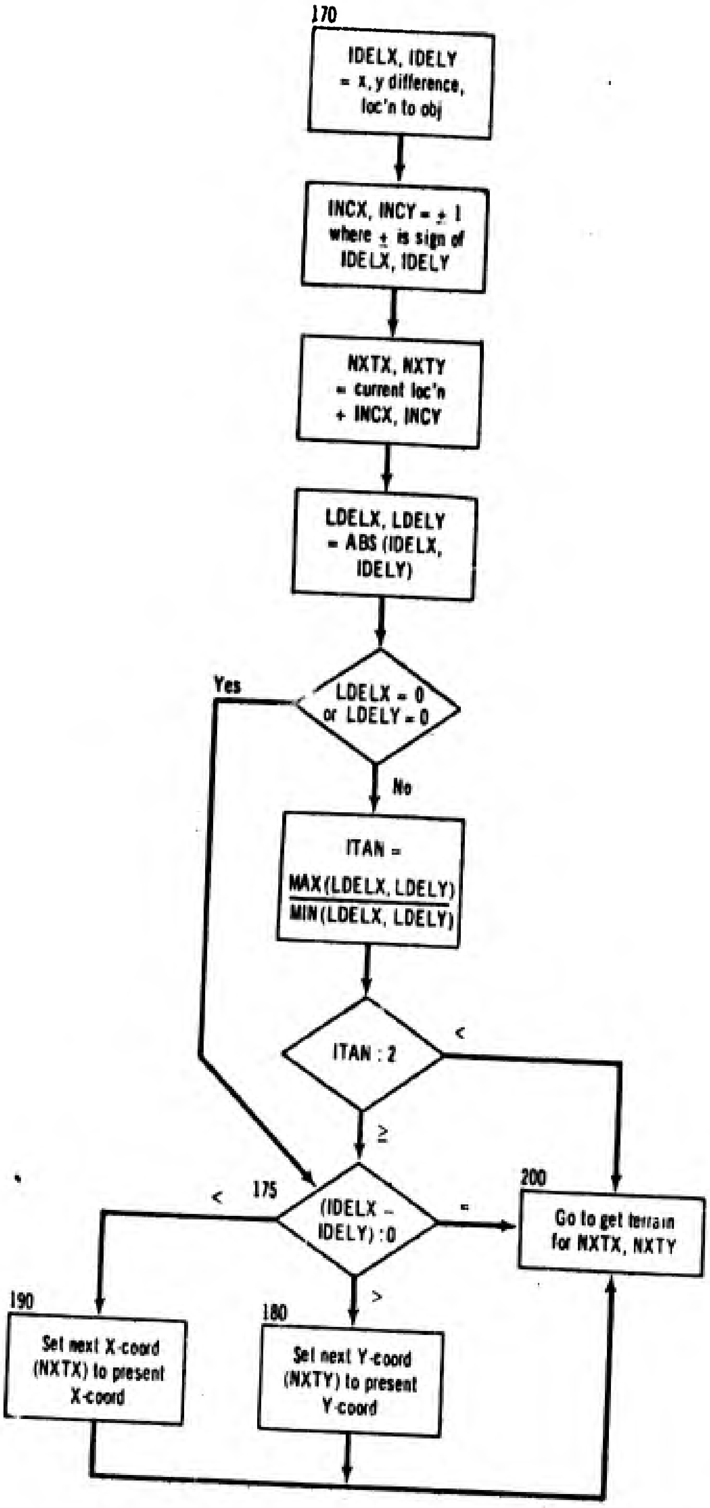
If the unit has orders which permit firing while moving and is not partially neutralized by direct fire, its weapons are checked before returning to calling program. If a weapon is busy, but not awaiting impact or assessment, its weapon event time and code are set to lower infinity and "decision."


Enter
Unpack JATRIB
KIND = 4 (PP and not moving)
No
Yes
Main wpn aimed
Yes
1
3
No
Unpack: obj coord, move doctrine, mobility, current terrain, move rates 0–6
Aircraft
No
Yes
Stay order
Yes
1
No
Alt: 2
<
≥
Get alt above ground and alt for level flight for this mobility class in LITA and LARGA
40
Pinned down
Yes
No
Stay order
Yes
1
No
5
5
MWG < 6 (move with stops permitted)
No
Yes
Neut DF or indirect fire
Yes
No
Able to fire
No
Yes
Halted to fire
Yes
No
109
Unit have tgt
No
Yes
110
Main wpn guided
No
Yes
111
Waiting impact
Yes
1
115
No
Get prob of movement (fn tgt, cover, mov doct)
RN: mov prob
≥
1
<
130
IXTI, IYTI = obj sq
170
Compute next sq
Aircraft
No
3
Yes
2


3
Road or CC for each sq → IT, IT1
270
Set KS according to slope
ITCB, ITBC = mov times for terrain
Terrain impassable
Yes
No
280
Set mov times = INFL
290
If part neut DF, ordered speed = 0
Neut ind fire only
Yes
No
Ordered speed max (= 7)
Yes
No
K = speed index
KT = speed
Reset ITCB, ITBC
300
Adjust if diag move
10
Rescale ITCB, ITBC
4
2
211
If diag move, set bit
215
IZT = alt
LAJ = alt + Ielev
If to land, LAA = Ielev – LAJ, IZS = 0
If treetop, LAA = elev + veg (next sq) – LAJ + 5
IZS = veg + 5
If alt above ground, LAA = elev + veg (next sq) + alt above ground – LAJ
IZS = veg + alt above ground
If alt plus elev LAA = LARGA – LAJ
IZS = LARGA
Pack LAA in JCNTRL
CALL MOVAIR
Pack IZS in JCNTRL
Unit already moving
Yes
No
CALL LSCHEK


4
Turn on move bit; set control code to bdy Xing; compute and store vel; pack ITBC, next loc'n
Aircraft
Yes
No
400
Write history
Can unit move and fire; kind = 3, > 5
Yes
No
Part neut DF
Yes
No
Wpn clks: INFU, INFL
=
≠
Main wpn
Yes
No
Guidance required
Yes
6
No
320
Code impact
Yes
No
6
6
Code assess
Yes
No
330
Pack wpn event for decision and time = INFL
340
350
RETURN
1
Turn off move bit; control code = decide

MOVE P.4



170
IDELX, IDELY = x, y difference, loc'n to obj
INCX, INCY = ± 1 where ± is sign of IDELX, IDELY
NXTX, NXTY = current loc'n + INCX, INCY
LDELX, LDELY = ABS (IDELX, IDELY)
LDELX = 0 or LDELY = 0
Yes
No
ITAN = MAX(LDELX, LDELY) / MIN(LDELX, LDELY)
ITAN : 2
<
≥
175
(IDELX - IDELY) : 0
<
=
>
200
Go to get terrain for NXTX, NXTY
190
Set next X-coord (NXTX) to present X-coord
180
Set next Y-coord (NXTY) to present Y-coord

NEUT

Purpose: To shift direct and indirect fire received and knowledge of enemy firing each 1/3 neutralization interval.

Arguments: Labeled common MAIN, CNTRL.

Called by: EXEC2.

Fire received is stored in each units eighth JCNTRL word for fire received this neutralization interval and the previous two intervals (actually 1/3 of the neutralization interval inputted). The current and two previous intervals are shifted and the current cleared using LLRD3,2,1 and LLRA3,2,1 as temporary storage. The LEE list and KEE list of JINTEL array are shifted using logical variable arrays LLEE1,2, 3 and LKEE1, 2, 3 as temporary storage.

NEWMIS

Purpose: To store the next order number in a unit's control word. Store the volleys to be fired if a fire order. If a stay order, sets tactics clock to recall this subroutine when the stay is terminated. If a skip order, performs the skip when the conditions are satisfied and stores the new order.

Arguments: Labeled common MAIN, CNTRL, HSTDAT.

Called by: TACTIC, EXEC2

The tactics clock and code are entered in LTCLK and LTCDE. If the main weapon is indirect fire, the support bit is turned OFF in JATRIB (indicating the weapon can provide artillery support). The next order number is entered in LTAGK, and if zero or too large, control goes to statement 20, and the unit is killed. MW is set equal to the mission word of the next order. MWDM is the next order mission word for the passenger unit if the unit is a troop carrier. MWG is then extracted from the mission word. If MWG equals zero, indicating a skip order, control goes to statement 1010. If not a skip order, control goes to statement 1200.

At statement 1200 MWR, MWB, MWTIME, MWF1, and MWF2 are extracted from the mission word (see notes on flow chart). At statement 40 the current order number is saved in LTAG, and the next order number is entered in LTAGK. (LTAGD and LTAGKD for a passenger unit.) At statement 42 the routing is according to MWG. If MWG equals seven (incorrect), control goes to 20. If MWG equals two, three, or six, control goes to statement 70, where the number of volleys is set to the maximum (7777), and control goes to 700 for packing, history message, and return to calling routine.

At statement 42, if MWG is equal to one, control goes to 45 where MWR controls the routing; two, three, or four are the only legal values for MWR. If MWR equals two, control goes to 390 where the tactics clock is set to current time plus MWTIME. If the unit is an aircraft, a call is made to LSCHEK. Control then goes to statement 420 where the tactics code is set for a call to TACTIC. If "kind of fire" is not zero, and priority of fire is not seven, and the weapon is direct fire, control goes to 60, and if MWB is not zero or seven, MWB is loaded into LSMCHK (the number of volleys), and control is returned to calling routine after packing and storing the history message (statement 700). If MWB equals zero or seven, control goes to statement 70. If MWR equals three, control goes to statement 400. If the current time is greater than MWTIME, the tactics clock is set equal to current time and control goes to 420. If the current time is not greater than MWTIME, control goes to statement 405 where the tactics clock is set equal to MWTIME. If the unit is an aircraft and the first two digits of MWTIME equal 50, and the mobility class is five, the air support bit in JATRIB is turned ON. Control then goes to 420. If MWR equals four control goes to 60.

The skip orders are processed beginning with statement 1010. The number of lines to skip is entered into LNSKIP, the kind of skip order into LPSKIP (see notes on flow chart). The value of LPSKIP (+1) determines the routing.

If (1) the skip is unconditional and control goes to 110. If the skip is back LNSKIP is made negative. Again LPSKIP determines the routing.

If (2) the skip is time and LTSKIP is equated to time to skip and control goes to 110.

If (3) the skip is on friendly units dead control goes to 1030. ISIDE is set equal to the friendly side, ISIDE units dead are counted in NCASU (statement 1050, DO 1060), the number of casualties to skip on is extracted into LCUSKP and control goes to 110.

If (4) the skip is on enemy known dead control goes to 1040. ISIDE is set equal to the enemy side, and control goes to 1050.

If (5) the skip is UNTIL a designated friendly unit is in a certain square, with three options if the friendly unit dies, control goes to 1070. The friendly unit number is entered in LFUNIT. If the friendly unit is not dead, control goes to 1072 where the coordinates in the order are entered in LFUXT and LFUYT and unit's location into IFUXS and IFUYS, and control goes to 110. If the friendly unit is dead, control goes to 1078 and the option is extracted in KVALUE. If the option is 1 (stay 63.99), bits 1-6 of the order are inserted in the stay order in MWSTAY. If the option is 2 (skip 1) no action is taken. If the option is 3 (go to escape point) control goes to 1090. The escape points are extracted from JSIDEP (DO 1092), the ranges to each are computed (DO 1094), the shortest range selected (statement 1096), and the created escape order, with the escape point coordinates goes to NEWSCP. In all three options control goes to 110 when processing is completed.

If (7) (6 is not used) the skip is on friendly casualties, control goes to 1110. ISIDE is set equal to the friendly side. At statement 1130 (DO 1140) the original and current number of men are extracted from JUCHAR for each unit on ISIDE and the casualties accumulated in NCAS. The number of casualties to skip is stored in LCSKIP, and control goes to 110.

If (8), skip on enemy casualties, control goes to 1120. The enemy side is stored in ISIDE and control goes to 1130.

If (9), skip is a given number of enemy units within a specified range, control goes to 1150. The number of enemy units and the range specified in the order are stored in MWEV and MWRG. At DO 1180 each enemy unit is checked. If known to nearest square and not known dead the coordinates are extracted and range to enemy unit computed. If the range is less than the specified range the unit is counted in NEAR. When the last enemy unit has been processed control goes to 110.

If (10), skip on a given number of friendly units dead of a specified vulnerability class, control goes to 1061. The side being processed is stored in ISIDE. Each friendly unit is checked (DO 1063). The vulnerability class of the unit is entered in LCV from JUCHAR and the class specified in the order into NTYPE. If LCV is equal to NTYPE, and the unit is dead it is counted in NCASU. Control then goes to 1065 (in skip on enemy units dead processing).

After statement 110 LPSKIP (+1) determines the routing. If (1) control goes to statement 180. The lines to skip is added to the current order number and control goes to statement 10 to process the new order.

If (2) control goes to 350. Current time is compared to LTSKIP. If current time is less than LTSKIP, control goes to 180. If equal to or greater than LNSKIP (lines to skip) is set equal to one (statement 170).

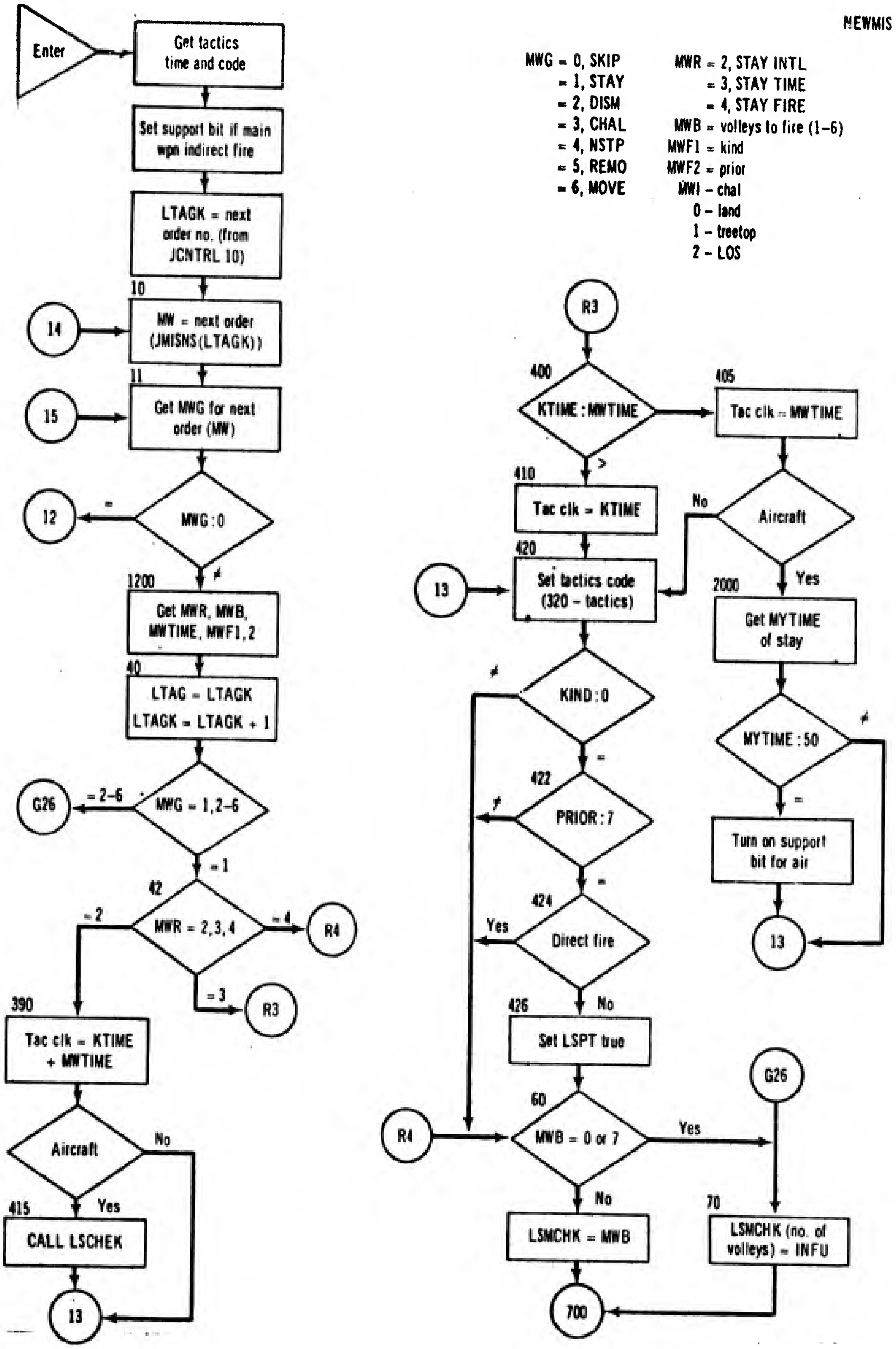
If (3, 4, or 10) control goes to 360. NCASU is compared with LCVSKP (casualties to skip). If NCASU is greater than LCVSKP, control goes to 180, otherwise it goes to 170.

If (5) control goes to 190. If the friendly unit is not dead, control goes to statement 220, where check is made to determine if the unit is in the designated square. If it is, control goes to 170, if not to 180. If the friendly unit is dead, KVALUE determines the routing. If the option is to stay MWSTAY is stored in the current order, MW, and control goes to statement 11 to process this order. If the option is escape, MWESCP is stored in MW and control goes to 11. If the option is "skip," control goes to 170.

If (7 or 8) control goes to 290 where NCAS is compared with the casualties to skip (LCSKIP). If NCAS is less than LCSKIP, control goes to 170, if greater than or equal to control goes to 180.

If (9) control goes to 330 where NEAR, the number of units within the specified range, is compared with MWEU, the number of enemy units designated. If NEAR is less than or equal to MWEU, control goes to 170, otherwise to 180.

NEWMIS

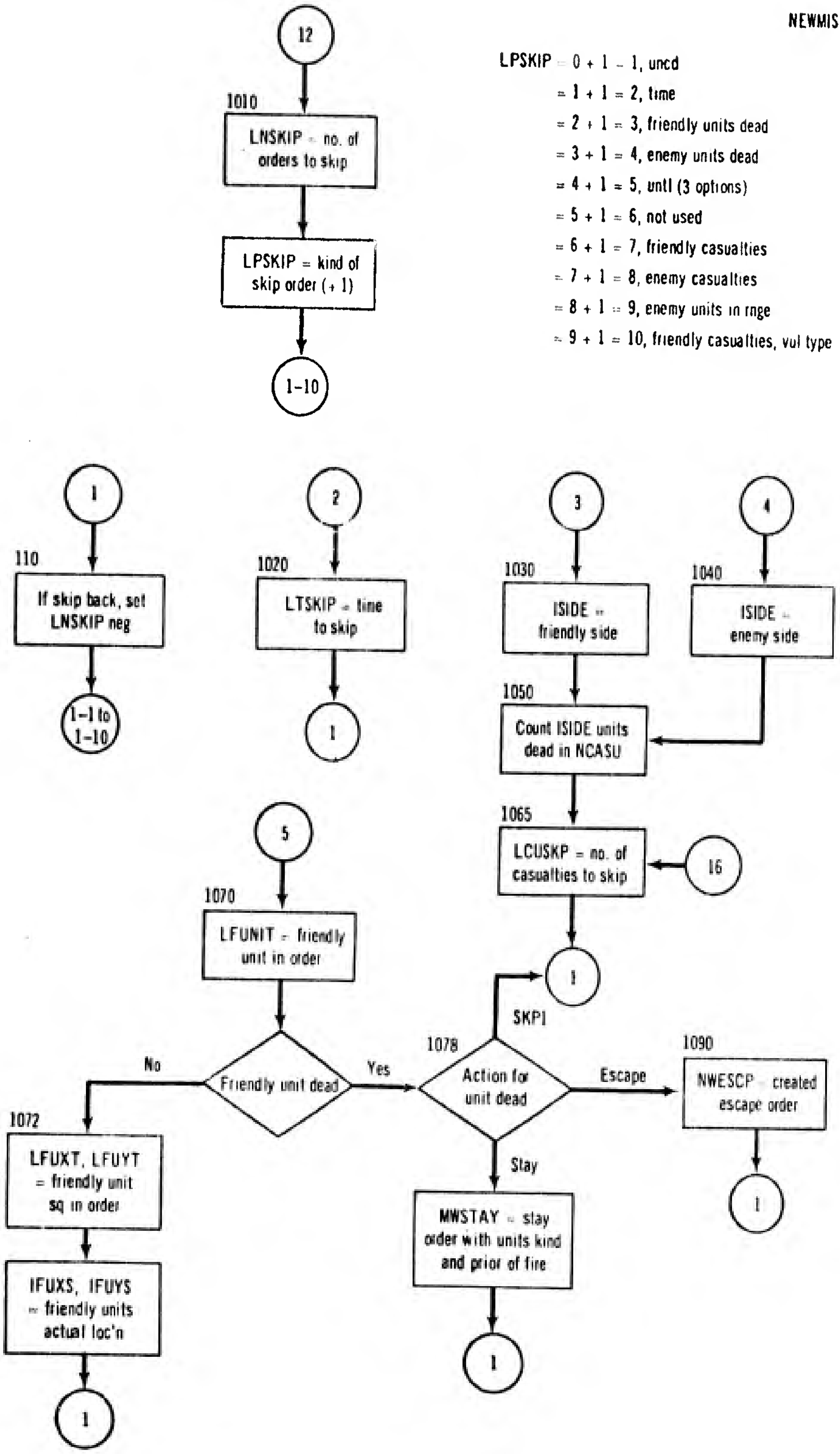

Enter
Get tactics time and code
Set support bit if main wpn indirect fire
LTAGK = next order no. (from JCNTRL 10)
10
14
MW = next order (JMISNS(LTAGK))
11
15
Get MWG for next order (MW)
12
=
MWG : 0
≠
1200
Get MWR, MWB, MWTIME, MWF1, 2
40
LTAG = LTAGK
LTAGK = LTAGK + 1
G26
= 2–6
MWG = 1, 2–6
= 1
42
= 2
MWR = 2, 3, 4
= 4
R4
= 3
R3
390
Tac clk = KTIME + MWTIME
Aircraft
No
415
Yes
CALL LSCHEK
13
R3
400
KTIME : MWTIME
405
Tac clk = MWTIME
>
410
Tac clk = KTIME
No
Aircraft
420
13
Set tactics code (320 – tactics)
Yes
2000
Get MYTIME of stay
≠
KIND : 0
MYTIME : 50
≠
=
422
≠
PRIOR : 7
=
Turn on support bit for air
=
424
Yes
Direct fire
13
426
No
Set LSPT true
G26
60
R4
MWB = 0 or 7
Yes
No
70
LSMCHK = MWB
LSMCHK (no. of volleys) = INFU
700

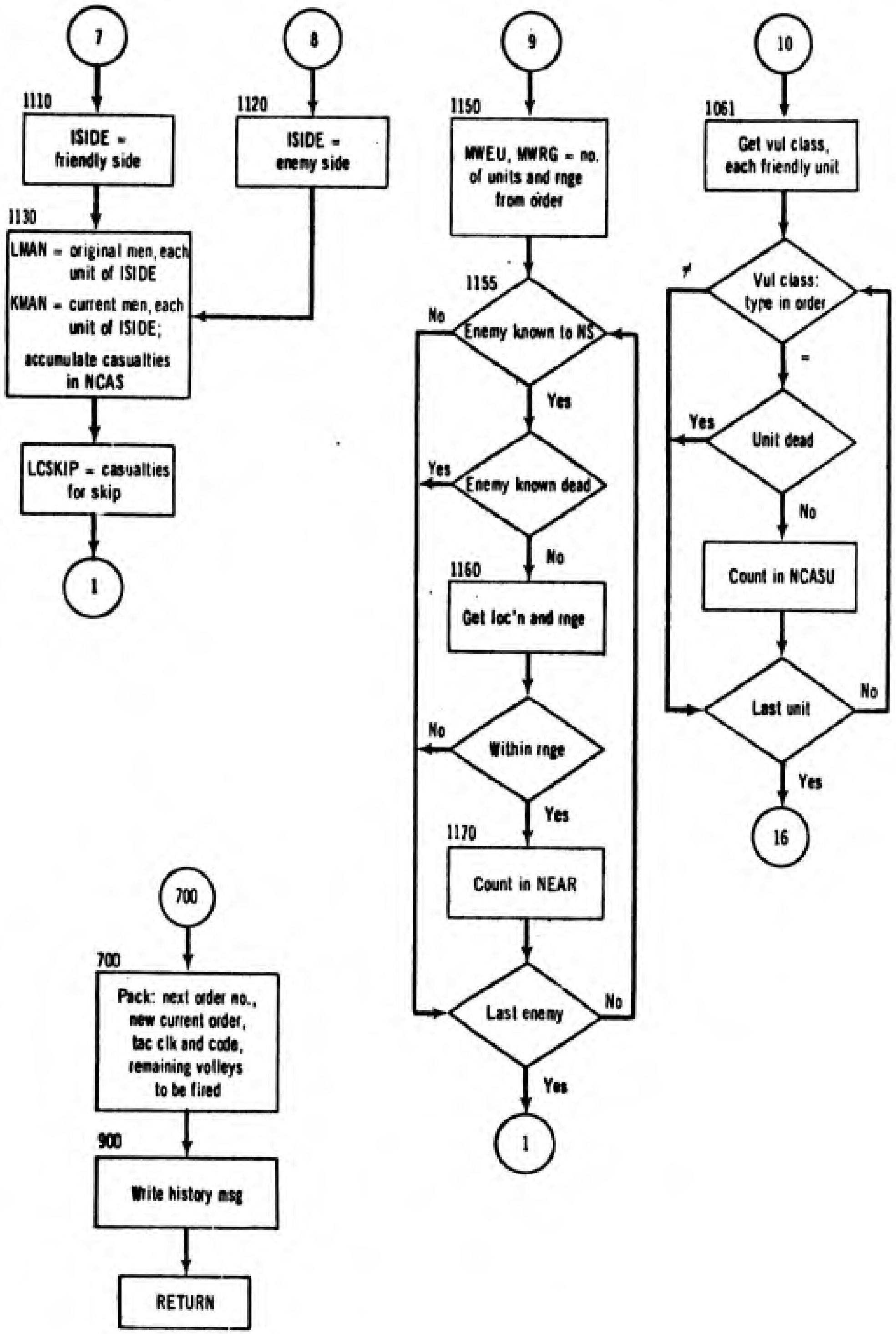
MWG = 0, SKIP
= 1, STAY
= 2, DISM
= 3, CHAL
= 4, NSTP
= 5, REMO
= 6, MOVE

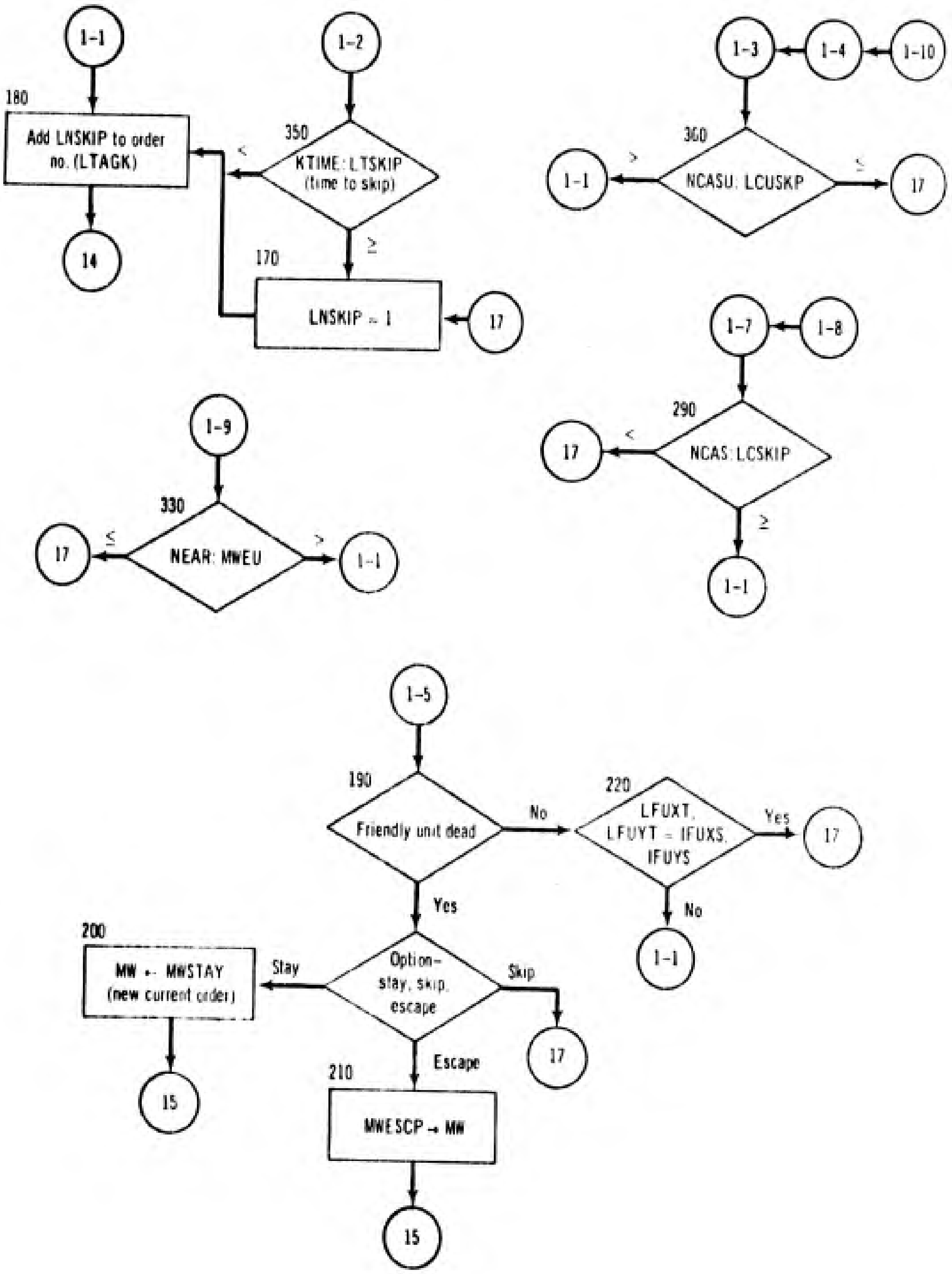
MWR = 2, STAY INTL
= 3, STAY TIME
= 4, STAY FIRE
MWB = volleys to fire (1–6)
MWF1 = kind
MWF2 = prior
MWI – chal
0 – land
1 – treetop
2 – LOS

NEWMIS-SKIP P.1

LPSKIP = 0 + 1 = 1, uncd
= 1 + 1 = 2, time
= 2 + 1 = 3, friendly units dead
= 3 + 1 = 4, enemy units dead
= 4 + 1 = 5, untl (3 options)
= 5 + 1 = 6, not used
= 6 + 1 = 7, friendly casualties
= 7 + 1 = 8, enemy casualties
= 8 + 1 = 9, enemy units in rnge
= 9 + 1 = 10, friendly casualties, vul type


12
1010
LNSKIP = no. of orders to skip
LPSKIP = kind of skip order (+ 1)
1-10
1
110
If skip back, set LNSKIP neg
1-1 to 1-10
2
1020
LTSKIP = time to skip
1
3
1030
ISIDE = friendly side
4
1040
ISIDE = enemy side
1050
Count ISIDE units dead in NCASU
1065
LCUSKP = no. of casualties to skip
16
1
5
1070
LFUNIT = friendly unit in order
Friendly unit dead
No
Yes
1072
LFUXT, LFUYT = friendly unit sq in order
IFUXS, IFUYS = friendly units actual loc'n
1
1078
Action for unit dead
SKP1
1
Escape
1090
NWESCP = created escape order
1
Stay
MWSTAY = stay order with units kind and prior of fire
1


7
1110
ISIDE = friendly side
1130
LMAN = original men, each unit of ISIDE
KMAN = current men, each unit of ISIDE;
accumulate casualties in NCAS
LCSKIP = casualties for skip
1
8
1120
ISIDE = enemy side
9
1150
MWEU, MWRG = no. of units and rnge from order
1155
Enemy known to NS
No
Yes
Enemy known dead
Yes
No
1160
Get loc'n and rnge
Within rnge
No
Yes
1170
Count in NEAR
Last enemy
No
Yes
1
10
1061
Get vul class, each friendly unit
Vul class: type in order
≠
=
Unit dead
Yes
No
Count in NCASU
Last unit
No
Yes
16
700
700
Pack: next order no., new current order, tac clk and code, remaining volleys to be fired
900
Write history msg
RETURN


1-1
180
Add LNSKIP to order no. (LTAGK)
14
1-2
350
KTIME: LTSKIP (time to skip)
<
≥
170
LNSKIP = 1
17
1-3
1-4
1-10
360
NCASU: LCUSKP
>
≤
1-1
17
1-7
1-8
290
NCAS: LCSKIP
<
≥
17
1-1
1-9
330
NEAR: MWEU
≤
>
17
1-1
1-5
190
Friendly unit dead
No
220
LFUXT, LFUYT = IFUXS, IFUYS
Yes
17
No
1-1
Yes
Option–stay, skip, escape
Stay
200
MW ← MWSTAY (new current order)
15
Skip
17
Escape
210
MWESCP → MW
15

Function NRN

Purpose:	To compute a normalized random number.
Arguments:	Labeled common MAIN, CNTRL.
Called by:	CLARTY, DESTGT, FIRING, IMPACT, TGTSEL.

This function uses function IRN and computes NRN. The positive or negative number is used for such computations as re-aim and re-load times.

POSDIS

Purpose:	The position disclosure subroutine determines if a unit upgrades its intelligence on an enemy unit which has fired. The upgrading depends on activity of observer, firing signature of the firer, solid angle thresholds for firing weapon and range. The JINTEL array of observing units is updated, if appropriate.
Arguments:	KWSIG (firing signature of firing weapon), and IXTGT, IYTGT (coordinates of the target of the firing weapon), and labeled common MAIN, CNTRL, HSTDAT.
Called by:	FIRING.

MI13 and MI34 are cleared. The routine turns ON the corresponding bits for enemy units that increase intelligence on the firing unit (the unit being processed) from no information to erroneous pinpoint and from erroneous pinpoint to pinpoint. The coordinates of the target unit are placed in IXT, IYT. KWS is computed equal to the firing signature squared and scaled 2^6. The line of sight bit pattern is extracted from JCNTRL into ILOS for the firing unit.

The DO 200 loop is then entered to process all enemy units. Artillery units, dead units, and units out of line of sight are not processed. The coordinates of the observing (enemy) unit are entered in IXTO and IYTO. If observing unit is pinned down, control goes to statement 150. If observing unit has target pinpointed, control also goes to 150

At statement 150 if the observer is not in the target square, control goes to statement 160 where bit is turned ON in JINTEL indicating knowledge that the enemy has fired on friends this neutralization interval. Control goes to end of DO 200 loop. If the observer and target are in the same square the bit is turned ON as fired at this unit during this neutralization interval, and control goes to end of DO 200 loop.

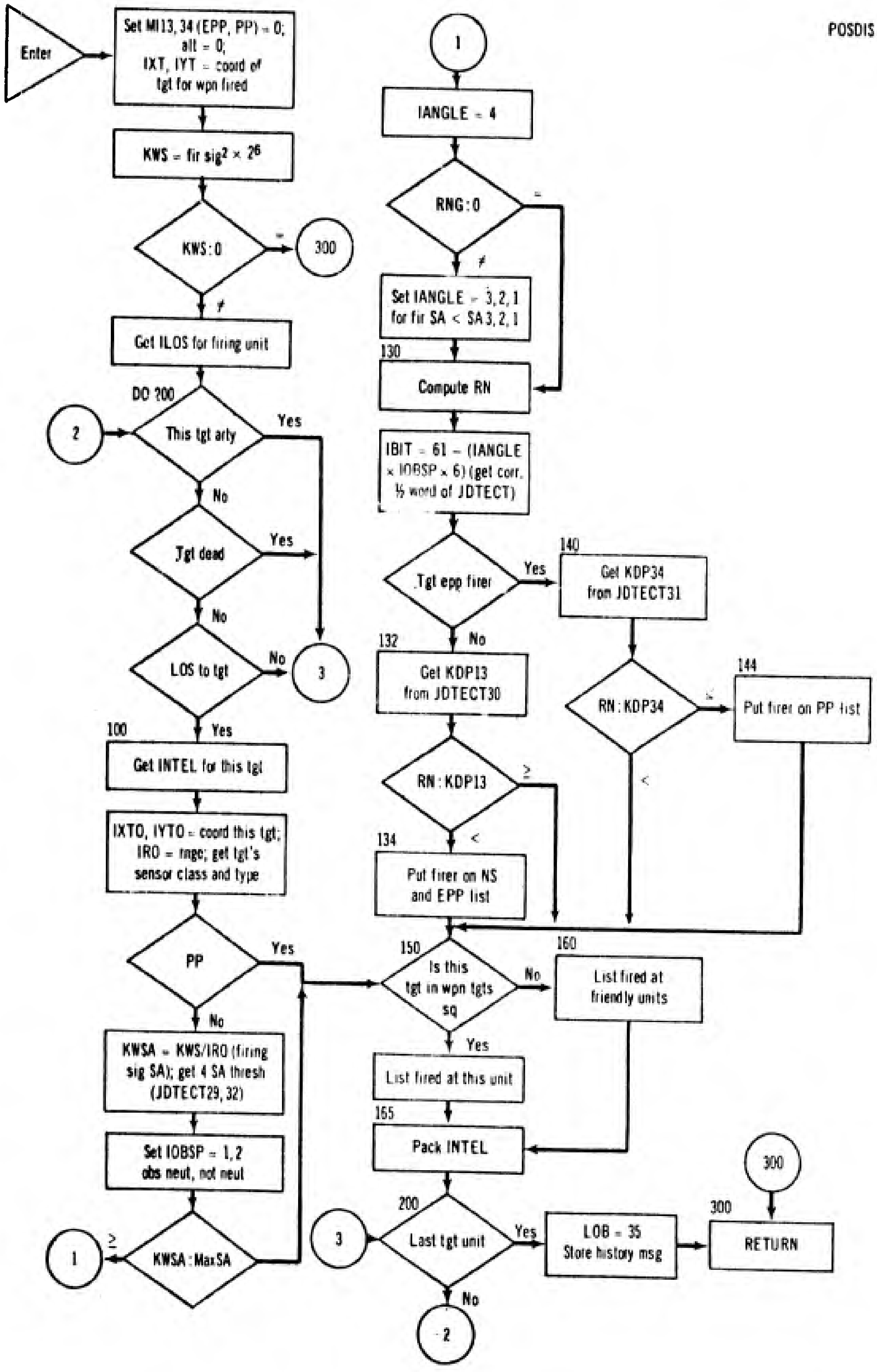
If the observing unit is neither pinned down nor has the firer pinpointed, the range from firer to observing unit is computed, and the observer's sensor class and type entered in LSC and LST. KWSA is computed by dividing LWS by the range (in grids squared). The solid angle thresholds for firing weapons are then extracted from JDTECT. The solid angle is then determined by considering observer firing or not, range and solid angle thresholds. The random number, NEWRN, is then selected and IBIT, the index for location of the field in JDTECT is computed. (See 130 on flow chart.)

Then if the observer has the firer erroneously pinpointed, NEWRN is compared with the probability of upgrading intelligence to pinpoint (statement 140). If the random number is less than the probability, the firer is placed on the observers pinpoint list, the bit is turned ON in MI34, and control goes to statement 150. If the random number is greater to or equal to this probability, control goes directly to statement 150.

If the observer does not have the firer erroneously pinpointed, control goes to statement 132. Here NEWRN is compared with the probability of upgrading information to erroneous pinpoint. If NEWRN is greater than or equal to this probability, control goes to statement 150. If less than, the firer is placed on observers NS and EPP lists in JINTEL, and the appropriate bit turned ON in MI13.

After exit from DO 200 the history message is stored using MI13 and MI34 as information, and control returned to calling routine.

POSDIS

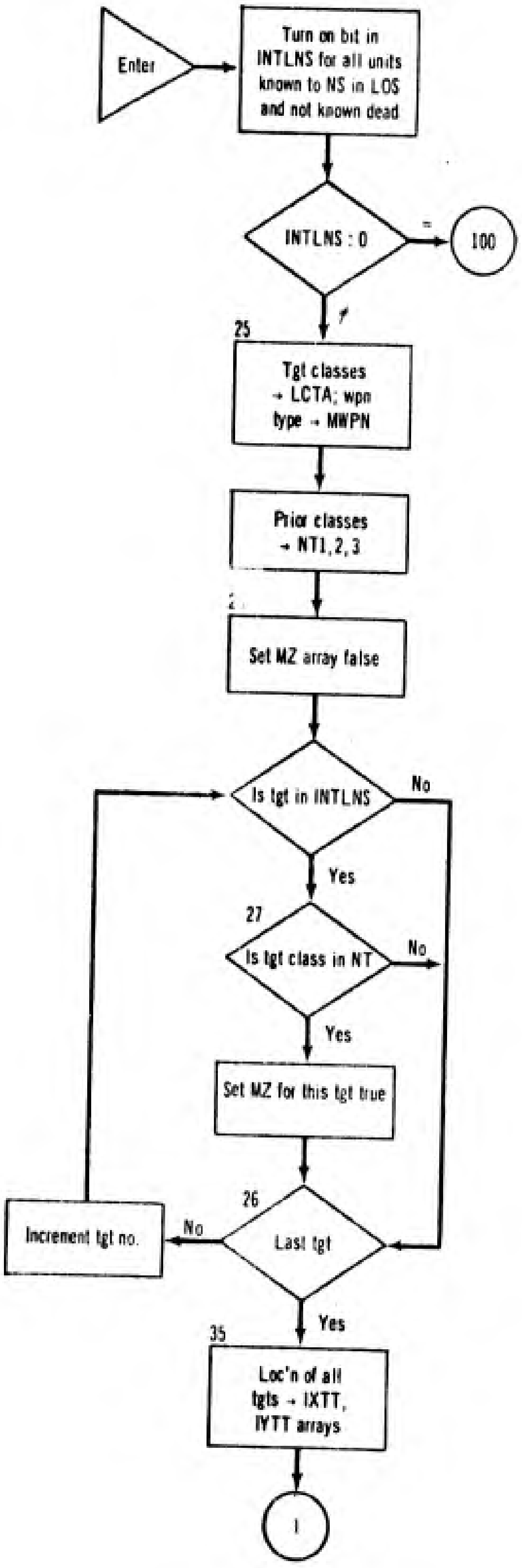

Enter
Set MI13, 34 (EPP, PP) = 0; alt = 0; IXT, IYT = coord of tgt for wpn fired
KWS = fir sig² × 2⁶
KWS : 0
=
300
≠
Get ILOS for firing unit
DO 200
2
This tgt arty
Yes
No
Tgt dead
Yes
No
LOS to tgt
No
3
100
Yes
Get INTEL for this tgt
IXTO, IYTO = coord this tgt; IRO = rnge; get tgt's sensor class and type
PP
Yes
No
KWSA = KWS/IRO (firing sig SA); get 4 SA thresh (JDTECT29, 32)
Set IOBSP = 1, 2 obs neut, not neut
1
≥
KWSA : MaxSA
1
IANGLE = 4
RNG : 0
=
≠
Set IANGLE = 3, 2, 1 for fir SA < SA 3, 2, 1
130
Compute RN
IBIT = 61 − (IANGLE × IOBSP × 6) (get corr. ½ word of JDTECT)
Tgt epp firer
Yes
140
Get KDP34 from JDTECT31
132
No
Get KDP13 from JDTECT30
RN : KDP34
≤
144
Put firer on PP list
<
RN : KDP13
≥
134
<
Put firer on NS and EPP list
150
Is this tgt in wpn tgts sq
No
160
List fired at friendly units
Yes
List fired at this unit
165
Pack INTEL
200
3
Last tgt unit
Yes
LOB = 35 Store history msg
300
300
RETURN
No
2

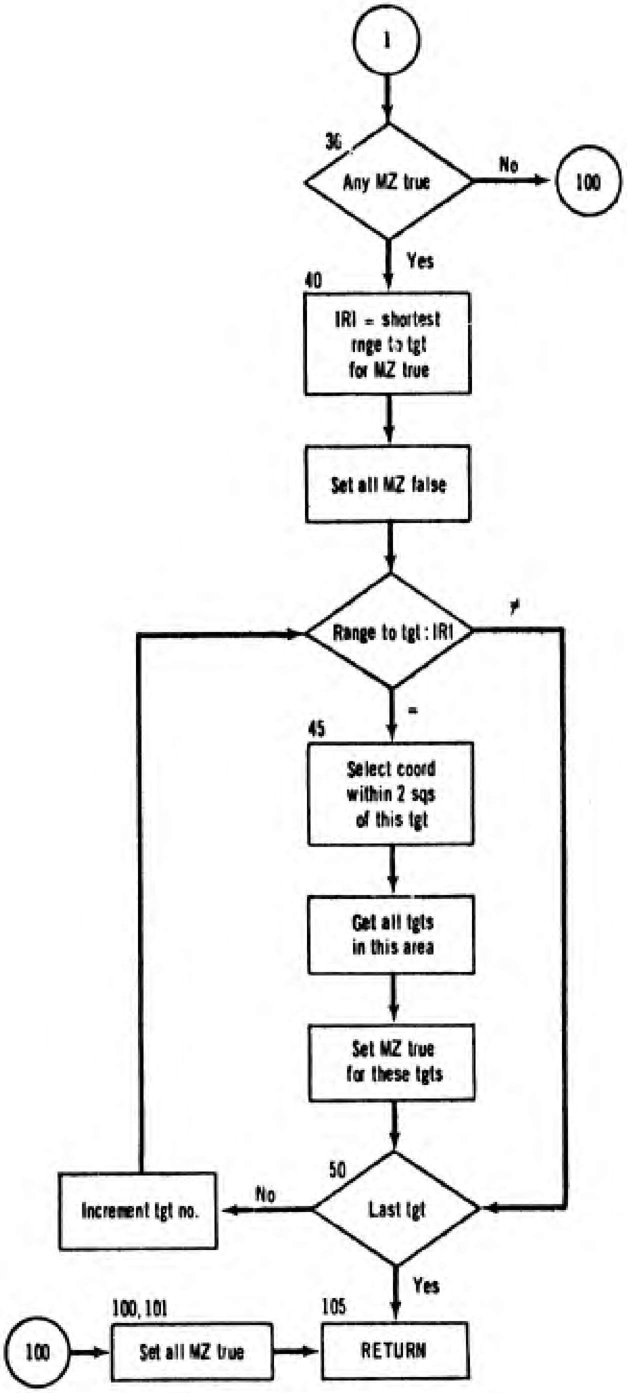
PRORTG

Purpose:	If surveillance for the unit being processed is restricted to make a list of enemy units which are to be placed under surveillance.
Arguments:	Labeled common MAIN, CNTRL, SURVEL.
Called by:	TGTACQ.

This subroutine sets the proper word in logical array MZ TRUE if surveillance is to be made on the enemy unit, FALSE otherwise. If the sixth bit of the unit's attribute word is ON, indicating unrestricted surveillance, control goes to statement 100 where all MZi are TRUE and control returns to TGTACQ.

If the sixth bit of the attribute word is not on all enemy units in line of sight, known to nearest square, and not known dead are processed. If the target class of the unit is on the top priority list of the unit being processed its MZi is set TRUE. The ranges to all enemy units are computed and the MZi remains TRUE only for those with the shortest ranges. MZi is set true for all units ± 1 one square from the units selected for surveillance.


Enter
Turn on bit in INTLNS for all units known to NS in LOS and not known dead
INTLNS : 0
=
100
≠
25
Tgt classes → LCTA; wpn type → MWPN
Prior classes → NT1, 2, 3
Set MZ array false
Is tgt in INTLNS
No
Yes
27
Is tgt class in NT
No
Yes
Set MZ for this tgt true
26
Last tgt
No
Increment tgt no.
Yes
35
Loc'n of all tgts → IXTT, IYTT arrays
1


1
36
Any MZ true
No
100
Yes
40
IRI = shortest rnge to tgt for MZ true
Set all MZ false
Range to tgt : IRI
≠
=
45
Select coord within 2 sqs of this tgt
Get all tgts in this area
Set MZ true for these tgts
50
Last tgt
No
Increment tgt no.
Yes
100, 101
105
100
Set all MZ true
RETURN

RESPNS

Purpose: This routine resets the "pinned down," "partially neutralized," "DF" and "IF" "responding to fire" bits in JATRIB. It also determines if an aircraft on a mission should abort the mission and sets up the abort order if appropriate, and sets for call to NEWMIS.

Arguments: Labeled common MAIN, CNTRL, HSTDAT.

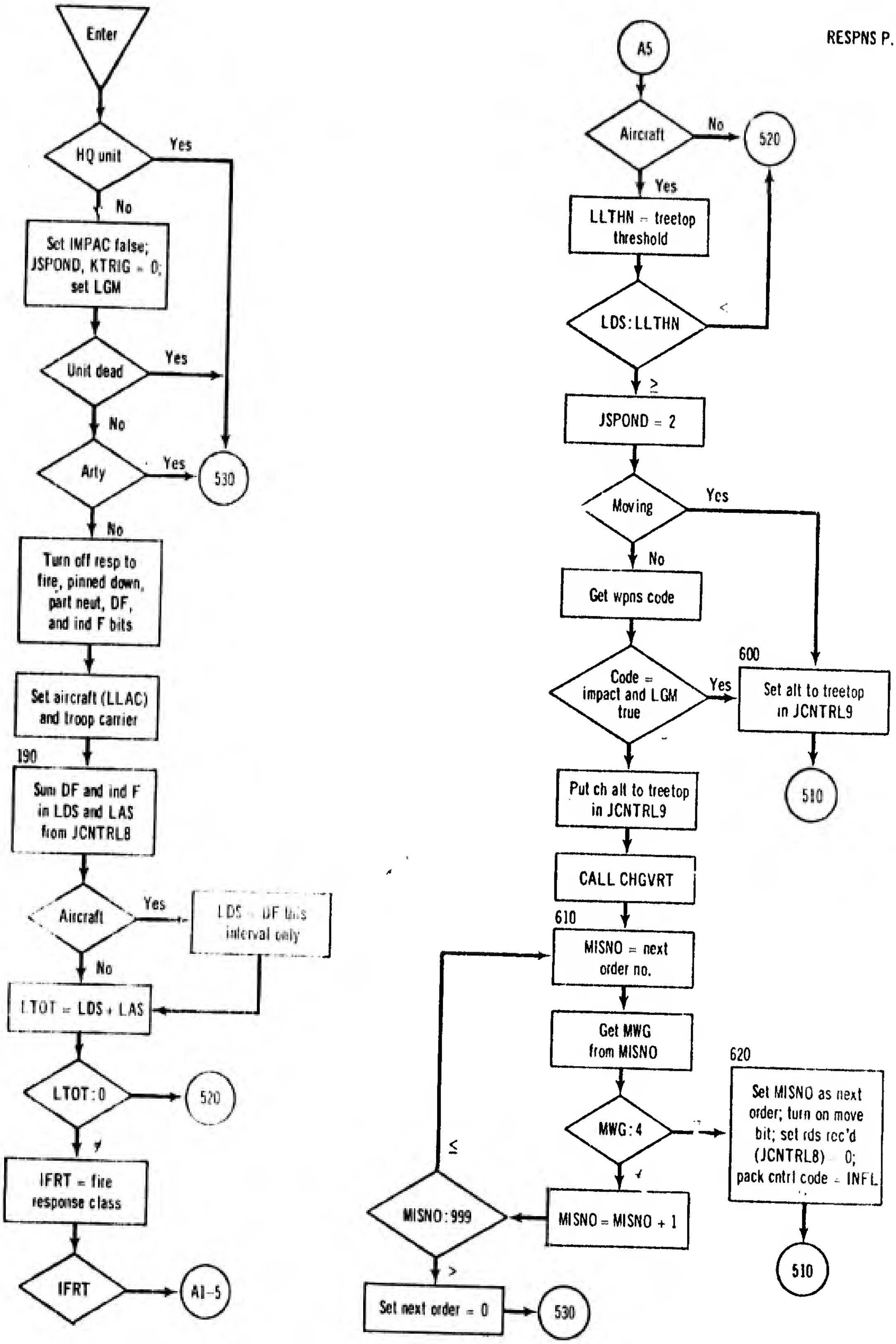
Called by: EXEC2. It is called each decision cycle and scan cycle for all units, and before FIRING for aircraft.

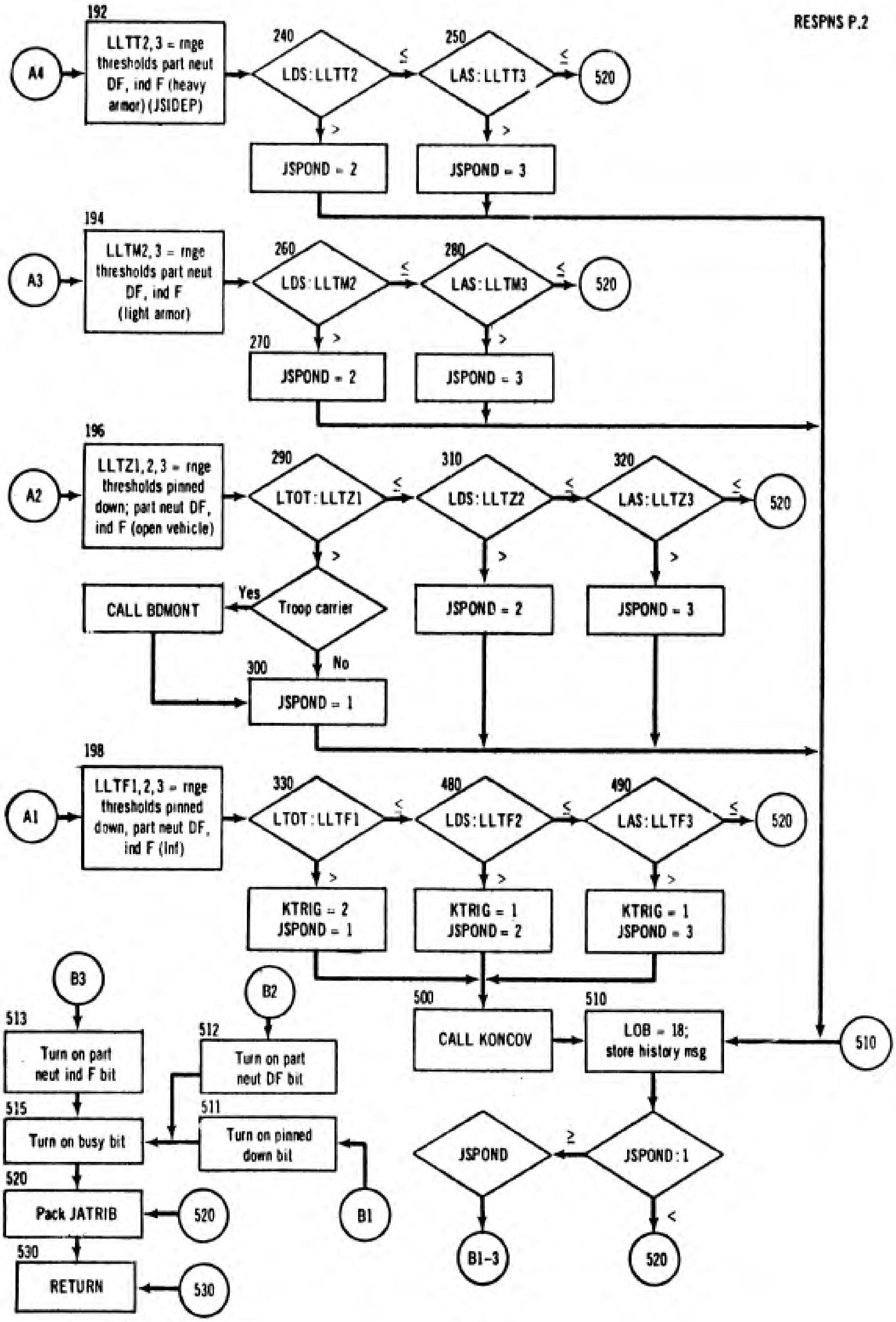
If a command unit, artillery unit, or if unit is dead, return is made to calling routine. "Response status" bits are turned OFF in JATRIB. Neutralization weight for direct and indirect fire received for this and the two previous neutralization intervals is accumulated in LDS and LAS (DO 190). LTOT is set equal to LDS plus LAS. If unit being processed is an aircraft, LDS is direct fire for the current neutralization interval only.

The fire response class is extracted from JUCHAR and entered in IFRT. The fire response thresholds are unpacked from the JSIDEP array for the proper fire response class. Note that only "dismounted infantry" and "open vehicles," fire response class 1 and 2, can be pinned down. LDS and LAS are then compared to these thresholds. If LDS and LAS are less than or equal to the appropriate thresholds, there is no suppression, and control returns to calling routine; if greater than, JSPOND is set for routing at statement 510, and control goes to 510. At 510 the history message is stored and the proper bit(s) in JATRIB turned ON.

Additional processing for air units begins at statement 210. If LDS is less then the threshold for response, control returns to calling program. If LDS is not less than the threshold, and the unit is not moving or is not awaiting impact or assessment for a guided missile, the aircraft will abort its current mission. This is accomplished by searching the list of orders starting with the current order until a move order is located. The move order number is inserted as the next order in JCNTRL. The rounds received is cleared, the "move" bit is turned ON in JATRIB, the tactics clock is set to lower infinity for immediate call to NEWMIS, and control goes to statement 510.

RESPNS P.1


Enter
HQ unit
Yes
No
Set IMPAC false; JSPOND, KTRIG = 0; set LGM
Unit dead
Yes
No
Arty
Yes
530
No
Turn off resp to fire, pinned down, part neut, DF, and ind F bits
Set aircraft (LLAC) and troop carrier
190
Sum DF and ind F in LDS and LAS from JCNTRL8
Aircraft
Yes
LDS = DF this interval only
No
LTOT = LDS + LAS
LTOT : 0
520
IFRT = fire response class
IFRT
AI-5
A5
Aircraft
No
520
Yes
LLTHN = treetop threshold
LDS : LLTHN
<
≥
JSPOND = 2
Moving
Yes
No
Get wpns code
600
Code = impact and LGM true
Yes
Set alt to treetop in JCNTRL9
510
Put ch alt to treetop in JCNTRL9
CALL CHGVRT
610
MISNO = next order no.
Get MWG from MISNO
620
MWG : 4
Set MISNO as next order; turn on move bit; set rds rec'd (JCNTRL8) = 0; pack cntrl code = INFL
510
≤
MISNO : 999
MISNO = MISNO + 1
>
Set next order = 0
530


RESPNS P.2
A4
192
LLTT2, 3 = rnge thresholds part neut DF, ind F (heavy armor) (JSIDEP)
240
LDS : LLTT2
≤
250
LAS : LLTT3
≤
520
>
JSPOND = 2
>
JSPOND = 3
A3
194
LLTM2, 3 = rnge thresholds part neut DF, ind F (light armor)
260
LDS : LLTM2
≤
280
LAS : LLTM3
≤
520
270
>
JSPOND = 2
>
JSPOND = 3
A2
196
LLTZ1, 2, 3 = rnge thresholds pinned down; part neut DF, ind F (open vehicle)
290
LTOT : LLTZ1
≤
310
LDS : LLTZ2
≤
320
LAS : LLTZ3
≤
520
>
Troop carrier
Yes
CALL BDMONT
No
300
JSPOND = 1
>
JSPOND = 2
>
JSPOND = 3
A1
198
LLTF1, 2, 3 = rnge thresholds pinned down, part neut DF, ind F (Inf)
330
LTOT : LLTF1
≤
480
LDS : LLTF2
≤
490
LAS : LLTF3
≤
520
>
KTRIG = 2
JSPOND = 1
>
KTRIG = 1
JSPOND = 2
>
KTRIG = 1
JSPOND = 3
B3
513
Turn on part neut ind F bit
B2
512
Turn on part neut DF bit
515
Turn on busy bit
511
Turn on pinned down bit
B1
520
Pack JATRIB
520
530
RETURN
530
500
CALL KONCOV
510
LOB = 18; store history msg
510
JSPOND : 1
≥
JSPOND
B1-3
<
520

SEEU

Purpose:	This subroutine turns the appropriate bit ON or OFF in the proper word, seeker or target, depending on the unit being processed being blue or red, if line of sight mutually exists between two units on opposite sides.
Arguments:	IU (the unit being processed), IS (the side), IEN (the target number), ISW (a switch that equals one if line of sight exists, zero if not).
Called by:	LSCHECK

JWORD is set to the unit being processed if the side is blue and to the target number if the side is red. NBIT is set to the target number if the side is blue and to the unit being processed if the side is red. If the switch ISW equals one (indicating line of sight exists between the units), the NBIT bit of the JWORD word of the array JLOS is turned ON. If ISW equals zero the bit is turned OFF.

Since this subroutine is entered in the DO 60 loop in LSCHEK it checks all targets for the unit being processed. Since line of sight is considered symmetrical, only a single dimension array is necessary for LOS information. The information in one word, ILOS, for the unit being processed is packed in JCNTRL of the unit being processed by the calling subroutine LSCHEK after exit from the DO 60 loop.

Logical Function STOP1

Purpose:	To check for stopping the simulation due to proximity of forces to a square.
Arguments:	Labeled common MAIN, CNTRL, RUN, HSTDAT.
Called by:	EXEC2.

This function computes the range to all enemy units not dead. If the proximity distance, which was input on Battle Model control card, is less than the range the unit is counted in KOUNT. If KOUNT is greater than the number of units input on the control card the function is returned TRUE, if not it is returned FALSE.

Logical Function STOP2

Purpose:	To determine if the simulation should be stopped due to personnel casualties.
Arguments:	Labeled common MAIN, CNTRL, RUN, HSTDAT.
Called by:	EXEC2.

If the casualty stopping conditions, KBLUFC or KREDFC, input on the control card, is exceeded by the accumulated casualties, KASBLU or KASRED, the function is returned TRUE, otherwise the function is returned FALSE.

Logical Function STOP3

Purpose: To determine if the simulation should be stopped due to vehicle casualties.

Arguments: Labeled common MAIN, CNTRL, RUN, HSTDAT.

Called by: EXEC2.

If the vehicle casualty stopping conditions, KBLUVC or KREDVC, input on the control card, is exceeded by the accumulated casualties, KASBVH or KASRVH, the function is returned TRUE, otherwise the function is returned FALSE.

SURV

Purpose:	The surveillance subroutine is the basis for generating intelligence for command units and weapon units. It is called each scan cycle for each sensor class and type. It sets up the call to TGTACQ and calls COMMO if the acquisition subroutine gets EPP information.
Arguments:	Labeled common MAIN, CNTRL, SURVEL.
Called by:	EXEC2.

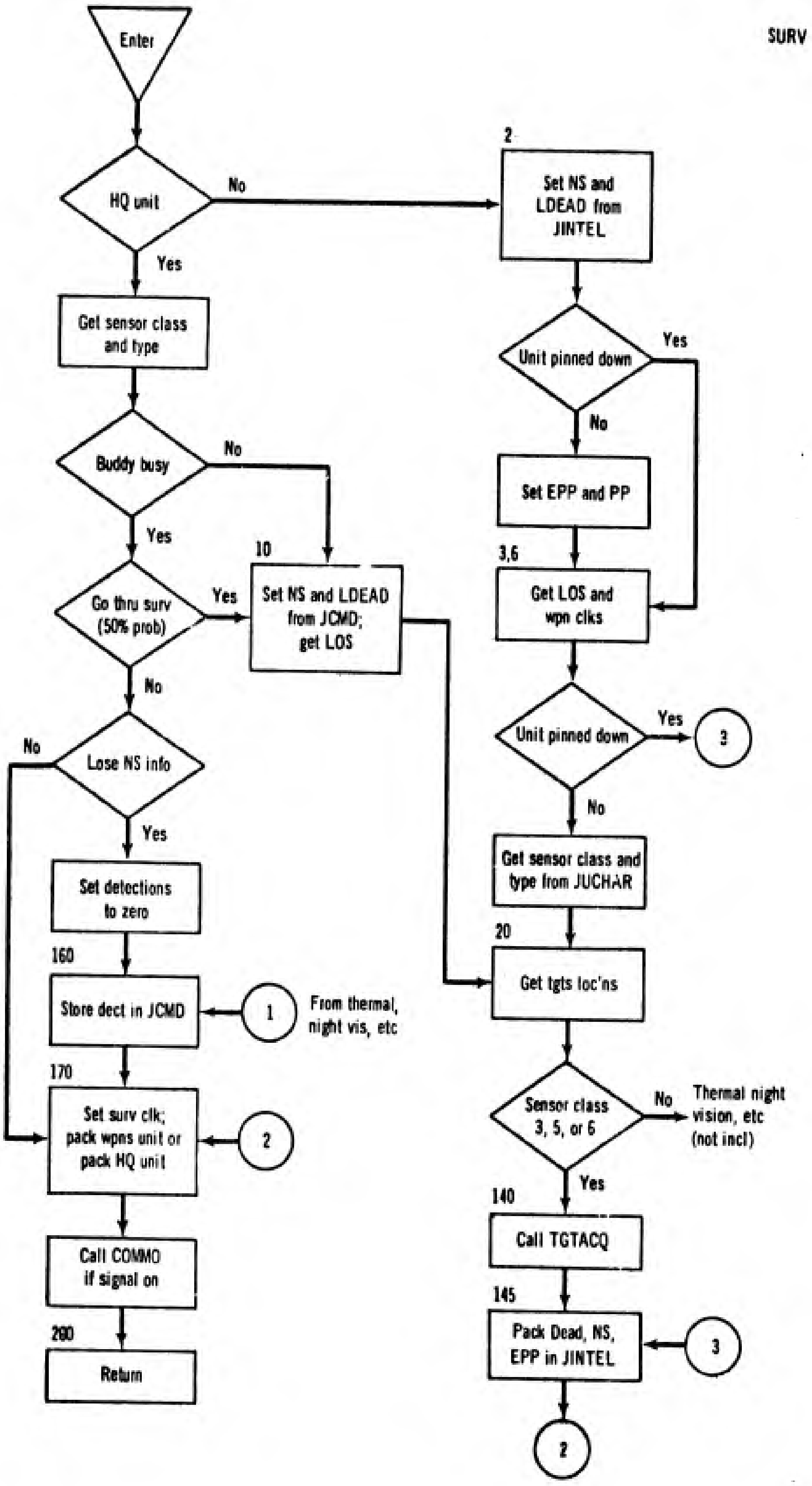
The subroutine first checks the pinned down status of the unit since a unit that is pinned down will lose all intelligence except nearest square. All intelligence, MI2, 3, and 4 for the unit being processed are set to FALSE (DO 5). If a command (headquarters) unit is being processed the sensor class and type are extracted from JCMD. If its buddy unit is busy a random number is checked as the command unit then has only a 50% chance of going through surveillance. If the RN is smaller than this chance the detections are set to zero.

If the buddy unit is not busy or if the random number permits the command unit to go through surveillance, MI2 and known dead are set. Control then goes to statement 20.

If a weapons unit is being processed MI2 and known dead are set, and if the unit is not pinned down, MI3 and MI4 are set (DO 3). The line of sight and all weapon event clocks and codes are extracted.

Location of all enemy units is then extracted for both command and weapons units. The probability of loss of information for the sensor is entered into LTI. If the sensor class is 3, 5, or 6, skip is to call TGTACQ (statement 140).

After return from target acquisition known dead, MI2, 3, and 4 information is assembled for transfer into JINTEL, the sensor clock and code are packed, the communications subroutine is called if switch was set in TGTACQ, and control is returned to EXEC2.


SURV
Enter
HQ unit
No
Yes
2
Set NS and LDEAD from JINTEL
Get sensor class and type
Unit pinned down
Yes
No
Buddy busy
No
Yes
Set EPP and PP
10
Go thru surv (50% prob)
Yes
Set NS and LDEAD from JCMD; get LOS
3,6
Get LOS and wpn clks
No
Unit pinned down
Yes
3
No
Lose NS info
No
Yes
Get sensor class and type from JUCHAR
Set detections to zero
20
160
Get tgts loc'ns
Store dect in JCMD
1
From thermal, night vis, etc
170
Sensor class 3, 5, or 6
No
Thermal night vision, etc (not incl)
Set surv clk; pack wpns unit or pack HQ unit
2
Yes
140
Call TGTACQ
Call COMMO if signal on
145
Pack Dead, NS, EPP in JINTEL
3
200
Return
2

TACTIC

Purpose: Whenever the execution of an order by a unit has been completed, or if it has an escape order option and its ammunition stock for the main weapon is depleted, its tactic clock and code are set for call to this routine. If the routine was entered for other than out of ammunition, NEWMIS is called. If NEWMIS did not kill the unit, its control clock is set for immediate decision. If the routine was entered due to the escape order option it is given an NSTP order to the nearest escape point.

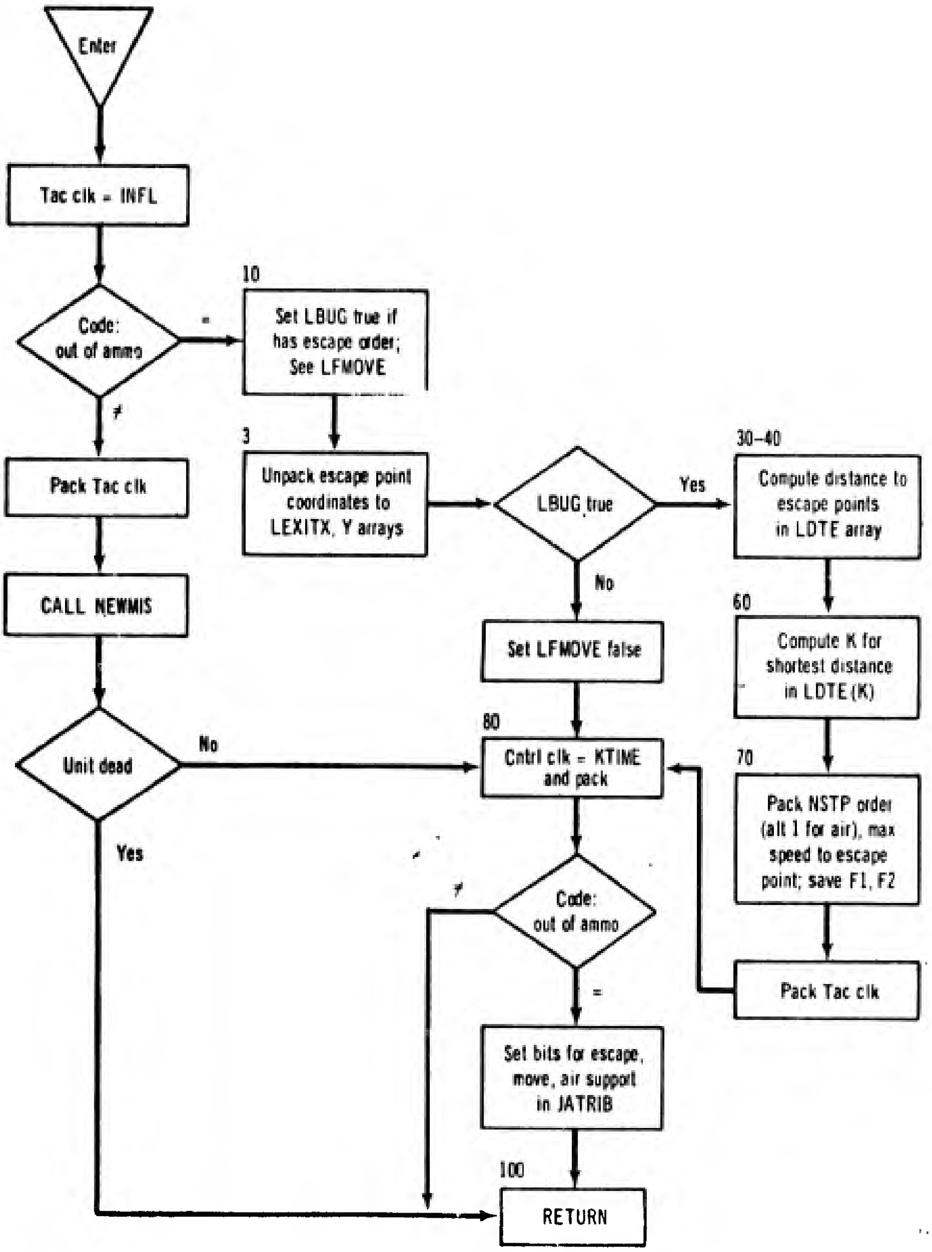
Arguments: Labeled common MAIN, CNTRL.

Called by: EXEC2.

LTCLK, the tactic clock to be packed later, is set to lower infinity. If the code is not 328, move to escape point, LTCLK is packed in JCNTRL and NEWMIS is called. If the unit is dead (it may have been killed in NEWMIS due to picking up a faulty order), control returns to calling program. If the unit is not dead, control moves to statement 80 where the units' control clock is packed equal to current time, and if not on an escape order, returns to calling program.

After LTCLK is set to lower infinity, above, if the code is "move to an escape point," control goes to statement 10. LBUG is set TRUE or FALSE if the unit has escape orders or not, and LFMOVE is set TRUE or FALSE depending on whether the unit is moving or not. If LBUG is not TRUE, LFMOVE is set FALSE, and control goes to statement 80. If LBUG is TRUE, control goes to statement 30, and the DO 3 loop stores the coordinates of the three escape points in the arrays LEXITX and LEXITY. The DO 40 loop stores the ranges to the escape points in array LDTE. The index of LEXITX and LEXITY for the shortest range is selected and entered into K at statement 60, and control passes to statement 70.

At statement 70, 33 is packed into the moving order mode and altitude of the order in JCNTRL. As this is 41 octal, this gives the unit a NSTP order with altitude 1. If the unit is not an aircraft, the MOVE routine will keep altitude at zero, if an aircraft will move at 5 feet above ground (including vegetation). The speed given is the maximum possible (7). LEXITX and LEXITY are packed into the coordinates of the objective, and the tactic clock is packed. Bits 19-24 of the order are cleared. Control then passes to statement 80. Here, if the unit is an aircraft and has an escape order, its air support bit in JATRIB is turned OFF. Control then returns to calling routine.


Enter
Tac clk = INFL
Code: out of ammo
=
≠
10
Set LBUG true if has escape order; See LFMOVE
3
Unpack escape point coordinates to LEXITX, Y arrays
LBUG true
Yes
No
30–40
Compute distance to escape points in LDTE array
60
Compute K for shortest distance in LDTE (K)
70
Pack NSTP order (alt 1 for air), max speed to escape point; save F1, F2
Pack Tac clk
Pack Tac clk
CALL NEWMIS
Unit dead
No
Yes
Set LFMOVE false
80
Cntrl clk = KTIME and pack
Code: out of ammo
≠
=
Set bits for escape, move, air support in JATRIB
100
RETURN

TERRA

Purpose:	To unpack the JLAND word.
Arguments:	Labeled common MAIN, TERRAN, LX, LY (coordinates of square being processed).
Called by:	CHGVRT, KONCOV, LS2TG, LOS, MOVE, IMADET, VISDET, BDMONT.

The terrain information for the square being processed is unpacked into LELEV, LVEG, LROAD, LTRAF, LCOV, and LCON.

TGTACQ

Purpose:	The target acquisition subroutine degrades or upgrades the intelligence states of information on all enemy units. These changes depend upon the detection probabilities for change of information depending on activity and movement of seeker, movement of target, and solid angle thresholds of sensor and range. If erroneous pinpoint information exists after processing, entrances to the communications and target select subroutines are set.
Arguments:	Labeled common MAIN, CNTRL, SURVEL, HSTDAT.
Called by:	SURV.

Enemy units known dead, moving, and apparent radius for detection are unpacked. If the unit being processed is moving and can fire while moving, its weapons' which are not awaiting impact or assessment, and where clocks are not upper infinity, has the event clock set to lower infinity (DO 7). This will force the weapon into target select. The solid angle thresholds and detection probabilities are unpacked (DO 4). The intelligence on number of units known to NS, EPP, and PP upon entering this subroutine is stored in MI2, 3, 4B. If a weapon unit is being processed, PRORTG is called; this sets the MZ TRUE for enemy units on which surveillance is to be performed.

The DO 100 loop processes all enemy units for which MZ is TRUE. If the unit is not in line of sight and not known dead, all intelligence is degraded one level. If unit is known only to NS, a random number is checked to determine if all information is lost. If the unit is not on the MZ TRUE list and line of sight is lost, all intelligence on the unit is lost. If in line of sight, all units in range and not concealed are counted. In either case all other intelligence is deleted if the enemy unit is known dead.

If MZ is TRUE and line of sight exists, control goes to stateme 130. Here the number in line of sight is incremented and the range is calculated. If the unit is not concealed (apparent radius of detection from JUCHAR not equal to zero) units not concealed, NKON, is incremented. KONSA (the solid angle) is computed by squaring the apparent radius, scaled 2^6 and divided by the range. (Recall the range is in grids squared.)

The first index (MOVE) for the LPij arrays are set (see comments). The variable JANGLE is then selected by comparing KONSA with the solid angle thresholds. This is the second index for the LPij. If the target is dead, a check is made to determine if the unit now learns target is dead. If so all intelligence is removed and processing this target stops (statement 105).

If target is not known dead, processing continues by referencing IRN and moving the random number into NEWRN. This is multiplied by two if the observer is moving.

If the target is accurately pinpointed, control goes to 260 where it is taken off the PP and EPP list. NEWRN is checked against LP41 (losing all info). If less than, control goes to 230 and target is taken off NS list. If NEWRN is less than the sum of PP to NS and PP to no information processing of this target is finished. If greater than or equal to, NEWRN is compared to the sum of PP to EPP and PP to no info, and if greater than or equal to, control goes to 210 where MI4, MI3, and MI2 are set TRUE. If less than, MI3 and MI2 are set TRUE. If a command unit and MI2 was TRUE, the corresponding bit in JCDET is turned ON.

If the target is erroneously pinpointed, control goes to statement 250 where MI3 is set FALSE. If NEWRN is set less than EPP to no info, control goes to 230. If greater than or equal to, is compared to the sum of EPP to NS and EPP to no info, if less than processing is completed. If greater than or equal to, is compared with the sum of EPP to PP and EPP to NS, and EPP to no info; if less than, target is added to EPP and PP list; if greater than or equal to, is added to EPP list.

If target is known to nearest square, control goes to 220. NEWRN is compared with NS to no info, if NEWRN is less than the NS to no info, the target is taken off the NS list. If NEWRN is greater than or equal to

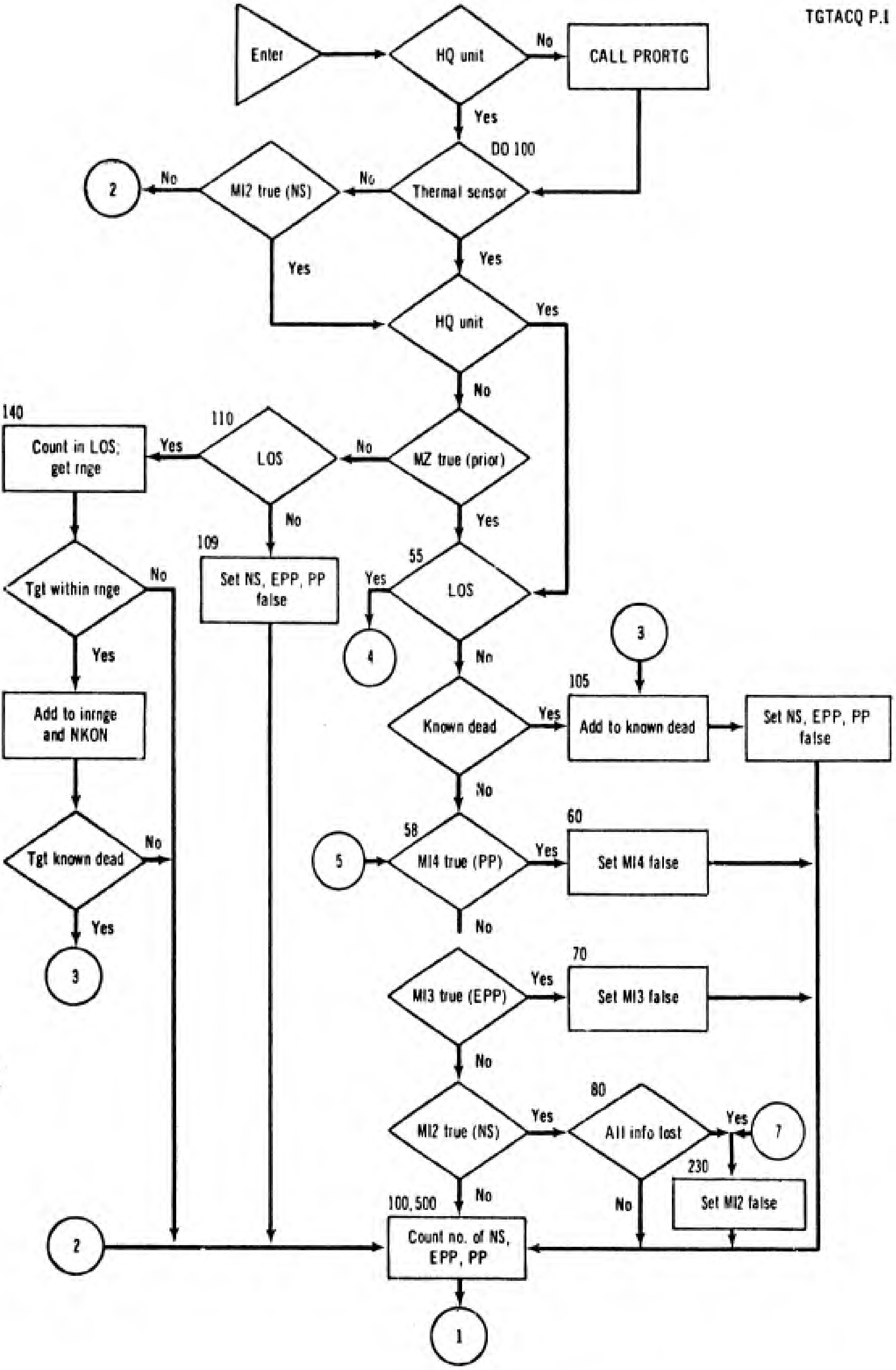
NS to no info, NEWRN is compared to the sum of NS to EPP and NS to no info. If NEWRN is less than this sum, the target is placed on the EPP and the NS list. If NEWRN is greater than or equal to this sum, NEWRN is compared to NS to PP + NS to EPP + NS to no info. If NEWRN is greater than NS to PP + NS to EPP + NS to no infor, processing of this unit is completed. If NEWRN is less than NS to PP + NS to EPP + NS to no info, the target is placed on the PP, the EPP, and the NS lists.

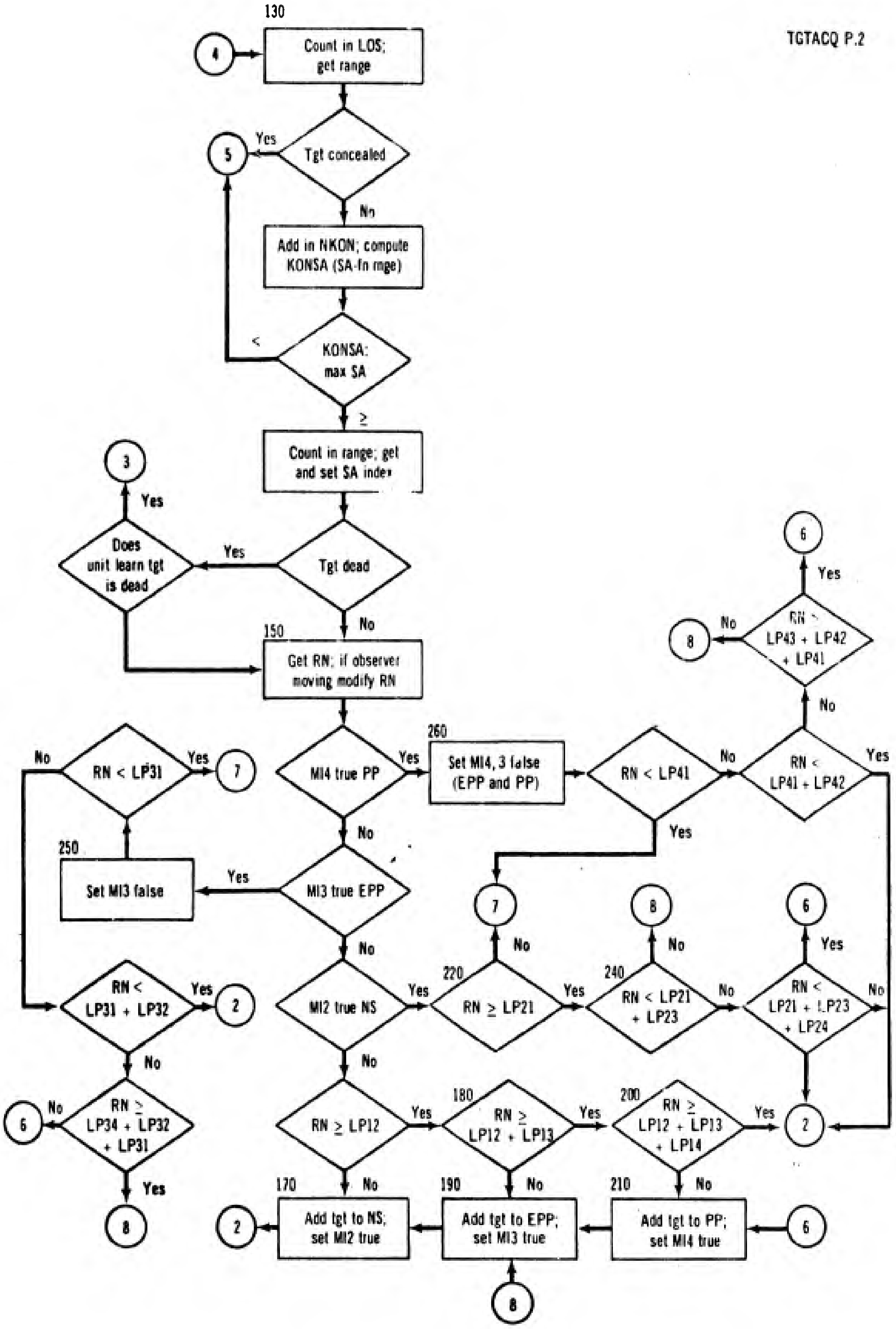
After exit from the DO 100 loop, control goes to statement 500 where the number of enemy units in each of the intelligence states are counted.

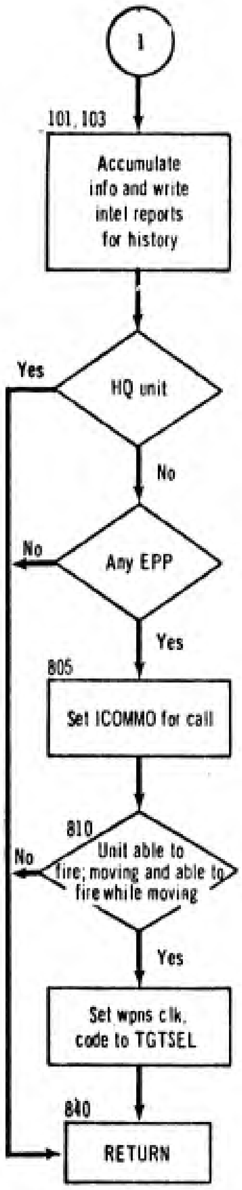
Then at DO 102 and statement 103, information for the three intelligence messages are stored for the history messages. At DO 802 if a weapon unit has any targets erroneously pinpointed, the switch, ICOMMO is set for the communications subroutine to be called from the surveillance subroutine. If no EPP information exist, control returns to calling routine.

If the unit being processed has a weapon able to fire, the first such weapon is set for call to target select, and control is returned to the surveillance routine.

TGTACQ P.I


Enter
HQ unit
No
CALL PRORTG
Yes
DO 100
2
No
MI2 true (NS)
No
Thermal sensor
Yes
Yes
HQ unit
Yes
No
140
Count in LOS; get rnge
Yes
110
LOS
No
MZ true (prior)
No
Yes
109
Set NS, EPP, PP false
55
Yes
LOS
Tgt within rnge
No
4
No
3
Yes
105
Add to inrnge and NKON
Known dead
Yes
Add to known dead
Set NS, EPP, PP false
No
60
58
Tgt known dead
No
5
MI4 true (PP)
Yes
Set MI4 false
Yes
No
3
70
MI3 true (EPP)
Yes
Set MI3 false
No
80
MI2 true (NS)
Yes
All info lost
Yes
7
230
100, 500
No
No
Set MI2 false
2
Count no. of NS, EPP, PP
1


TGTACQ P.2
130
4
Count in LOS; get range
Tgt concealed
Yes
5
No
Add in NKON; compute KONSA (SA-fn rnge)
KONSA: max SA
<
≥
Count in range; get and set SA index
Tgt dead
Yes
Does unit learn tgt is dead
Yes
3
No
150
Get RN; if observer moving modify RN
MI4 true PP
Yes
260
Set MI4, 3 false (EPP and PP)
RN < LP41
No
RN < LP41 + LP42
No
RN > LP43 + LP42 + LP41
Yes
6
No
8
Yes
Yes
7
No
MI3 true EPP
Yes
250
Set MI3 false
RN < LP31
Yes
7
No
RN < LP31 + LP32
Yes
2
No
RN ≥ LP34 + LP32 + LP31
No
6
Yes
8
No
MI2 true NS
Yes
220
RN ≥ LP21
No
7
Yes
240
RN < LP21 + LP23
No
8
No
RN < LP21 + LP23 + LP24
Yes
6
No
2
No
RN ≥ LP12
Yes
180
RN ≥ LP12 + LP13
Yes
200
RN ≥ LP12 + LP13 + LP14
Yes
2
170
No
Add tgt to NS; set MI2 true
2
190
No
Add tgt to EPP; set MI3 true
8
210
No
Add tgt to PP; set MI4 true
6


1
101, 103
Accumulate info and write intel reports for history
HQ unit
Yes
No
Any EPP
No
Yes
805
Set ICOMMO for call
810
Unit able to fire; moving and able to fire while moving
No
Yes
Set wpns clk, code to TGTSEL
840
RETURN

TGTSEL

Purpose:	This subroutine does the actual selection of the target, if target was acquired in Target Acquisition, or selects the area for suppresive fire.
Arguments:	Labeled common MAIN, TREAT, TGTSL, CNTRL, HSTDAT.
Called by:	EXEC2. (See labeled common TGTSL in labeled common section)

After unpacking, if the weapon is direct fire, DO 15 loop is entered and NS and EPP list are made up. If EPP exists, the LKEE and LLEE lists are set and target classes of enemy units extracted. The vulnerability class of the selecting unit is stored in N. The MCVTS and MCVTM arrays are filled by target class and range bracket.

If direct fire (statement 20) and the unit can call artillery (statement 21) the nearest square list is checked, if it contains targets, kind of fire is checked for zero (do not fire), if not zero, kind is then checked for being odd (pinpointed targets in designated square), if not add (PP target anywhere) the EPP list is checked (DO 2888) and if it contains targets, control goes to statement 120. If kind is odd, the EPP check is bypassed.

Above, if kind equals zero (statement 28) priority is checked at 40, if this is not equal to seven, exit is set up, if equal to seven, not artillery, and weapon is available, aim time and area target are set and program set to return to calling routine.

At statement 120 and DO 140, available crew for the weapon is checked by subtracting men firing other weapons in the unit from its current strength. If no crew is available, return is set up, if any crew is available, control goes to statement 60 where the ITL list is set (DO 65). If kind is odd the ITL1 list is set (DO 70). At 72 kind is checked for greater than or equal to four (if so it is not a support unit), if it is not a support unit, targets on ITL list are checked (DO 92). If there are none return is set up. If there are targets on ITL, kind is checked for PP targets in a designation square, if the order has this kind the ITL1 list is checked and if it contains targets, the ITL1 array is transferred to ITL and the MT1, MT2, and MT3 lists are constructed (statement 150, DO 152). If kind does not call for PP targets in a designated square and no targets in ITL1, the MTi lists are constructed without the ITL1 to ITL transfer.

Next at statements 155-180, ranges to targets in the ITL list are computed, and using these ranges and the MCTVS and MCTVM arrays the MV1, MV2, MX3 lists are constructed.

Then at DO 181 and DO 182 the MX1 and MX2 lists are constructed using MV1, MV2, MT1, MT2, and MT3. DO 183 checks for targets on MX1, if there are none, control goes to statement 190 where priority is checked for routing to CALL OPFRST (opportunity first) or CALL DGFRST (danger first). If targets are on MX1 and unit can call artillery and is either pinned down or partially suppressed by direct fire, the MX1 array is transferred to MX and artillery is called before going to danger first or opportunity first.

Either OPFRST or DGFRST will construct the MTL1 and MTL2 lists and enter the number of targets on MTL2 in NOTGTS.

After OPFRST returns control to TGTSEL if there are targets on MTL2, designate target (DESTGT) is called. If there are no targets on MTL2 after return from DESTGT, kind is checked for suppressive fire. If it is suppressive fire, ISIG is set equal to one, if not the target description is set to zero and area fire bit is turned OFF. In either case control goes to statement 200 where ISIG is checked against zero. If equal to zero, control is returned to EXEC2. If not equal to zero, the range to the target is computed (line of sight checked first if direct fire). If the crew available is insufficient, the target word is cleared and the weapon event clock is set to lower infinity and return is made. If the crew is sufficient the target description is packed, the area fire bit is turned ON, aim time is computed and stored, weapon event clock and code are set, the history message is stored and control returned to EXEC2.

If the danger first path was followed NOTGT is checked. If equal to one, DESTGT is called. If equal to zero and order is suppressive fire, ISIG is set equal to one, and control goes to statement 200. If not suppressive fire, the target word is cleared and control goes to 200.

If NOTGT is greater than one after DGFRST, the MTL3 list is constructed from MTL2 and MV1 and targets counted in NTGT (statements 641, 644). If NTGT does not equal zero, the MTL3 array is transferred to MTL2 (DO 651), and control goes to call DESTGT. If NTGT equals zero, the MTL3 list is constructed from MTL2 and MV2 and targets counted in NTGT. NTGT is not equal to zero, MTL3 is transferred to MTL2 and designate target is called. If NTGT is now equal to zero this indicates that MTL2 was built from MX3 in DGFRST, and control goes to 360 to call DESTGT.

TGTSEL Notes

MI2 – NS

MI3 – EPP

MI4 – PP

MCVTS
MCVTM – Serious or mod vul

MX – NS and rnge ≥ 2 (for arty call)

ITL – EPP and LOS

ITL1 – ITL and within 2 sqs of tgt

MT1 – fired at unit

MT2 – fired at friends

MT3 – neither and EPP

MV1 – seriously vul

MV2 – mod vul

MX3 – invul

MX1 – fired at unit and seriously or mod vul

MX2 – Fired at unit friends and seriously or mod vul

MTL1 – EPP, LOS, and in rnge

MX – fired at unit and vul (wpn unit call arty)

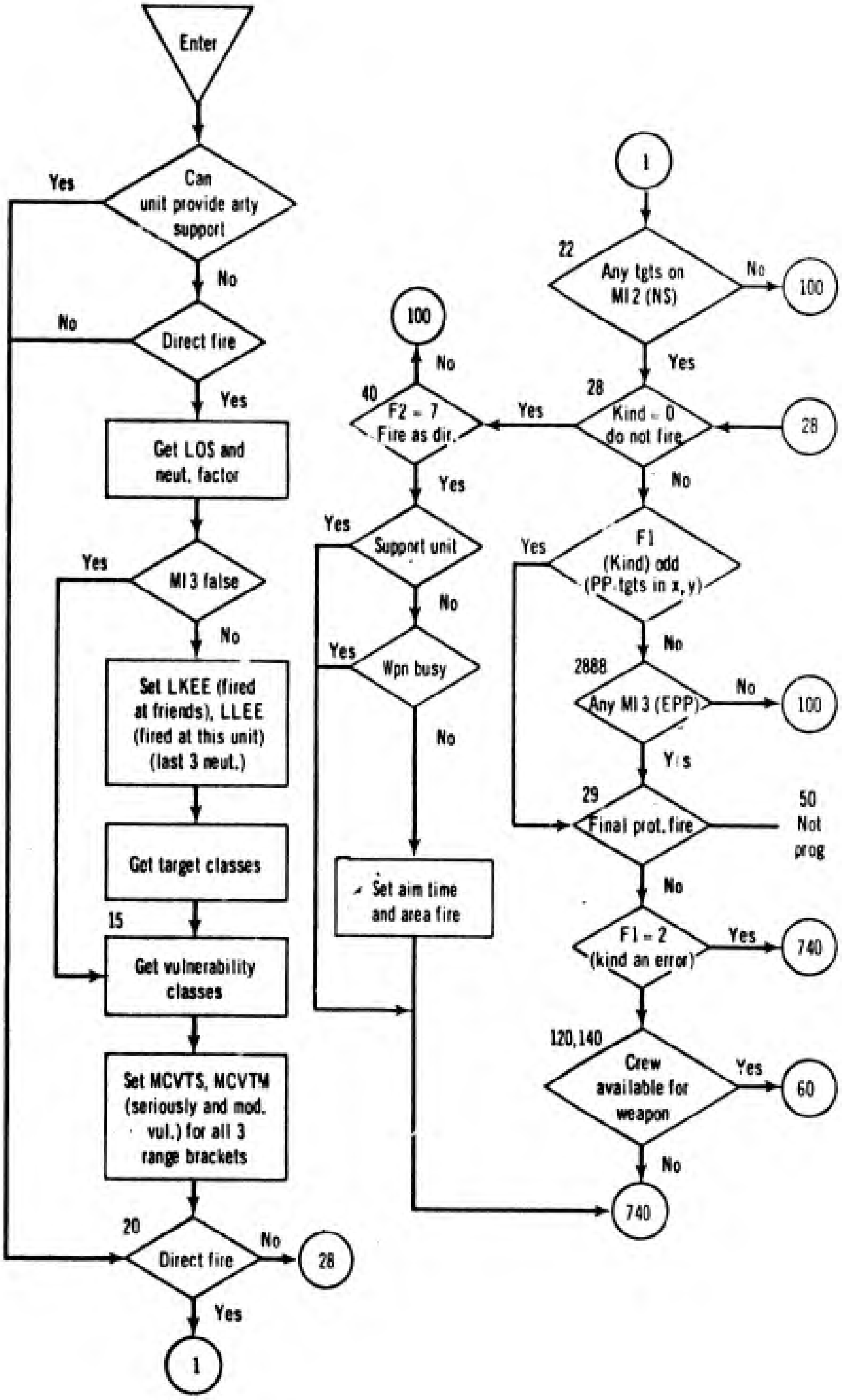
MTL2 – EPP, LOS, fired at unit, seriously or mod vul, on prior list

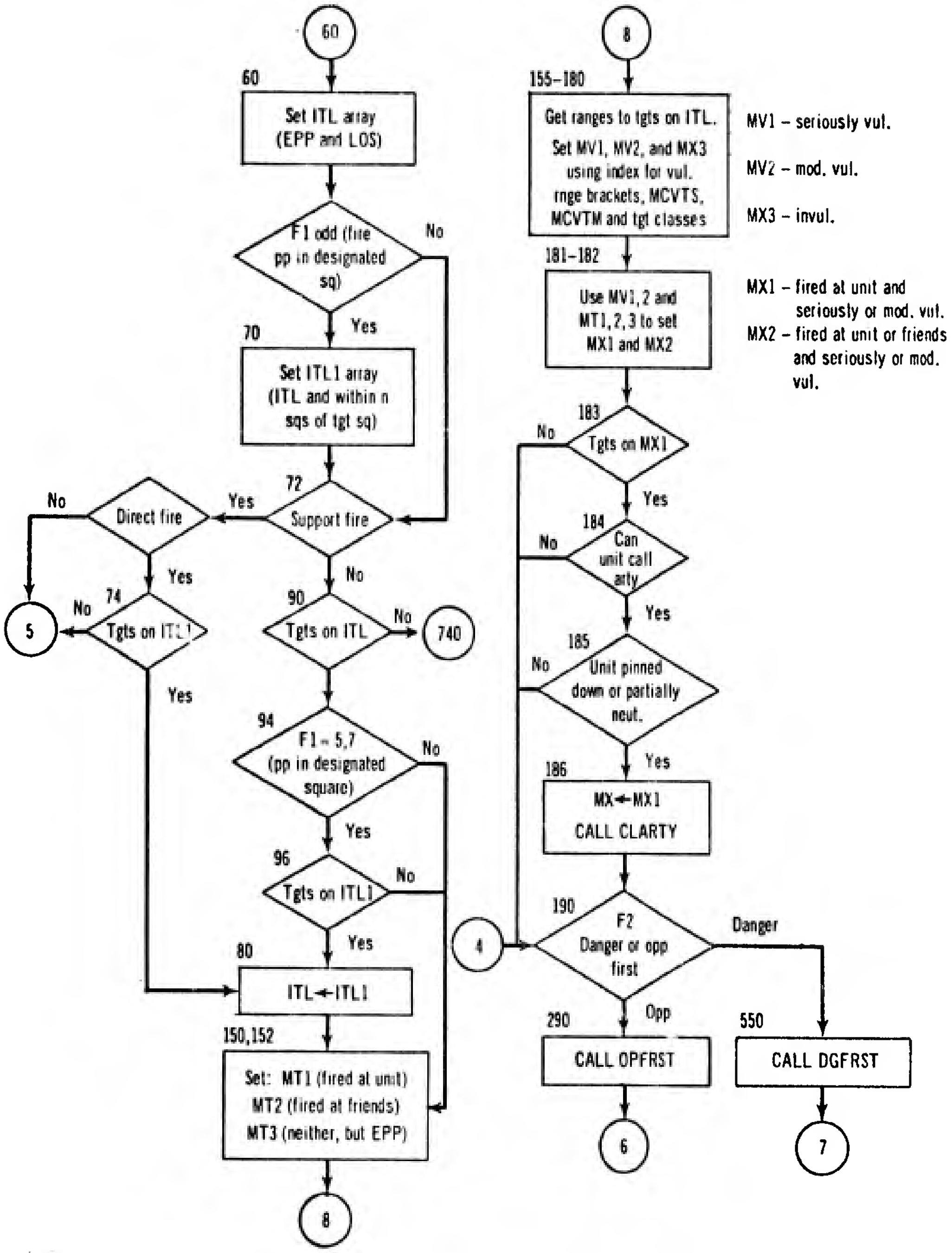
LFRIA – MTL2 and pinned down

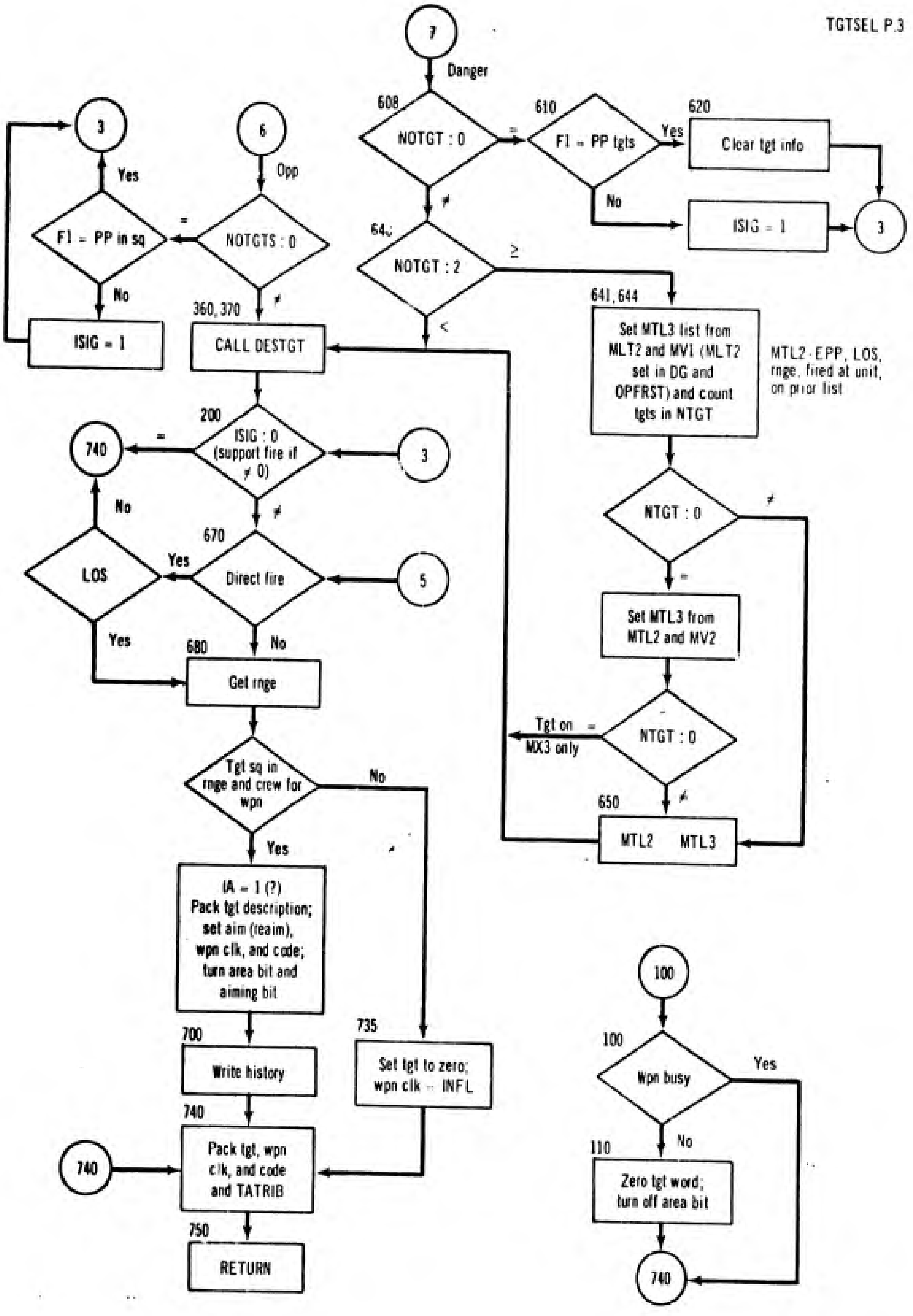
MTL3 – MTL2 and seriously vul

KEE list – fired at friends

LEE list – fired at this unit


Enter
Can unit provide arty support
Yes
No
Direct fire
No
Yes
Get LOS and neut. factor
MI 3 false
Yes
No
Set LKEE (fired at friends), LLEE (fired at this unit) (last 3 neut.)
Get target classes
15
Get vulnerability classes
Set MCVTS, MCVTM (seriously and mod. vul.) for all 3 range brackets
20
Direct fire
No
28
Yes
1
100
No
40
F2 = 7 Fire as dir.
Yes
Support unit
Yes
No
Wpn busy
Yes
No
Set aim time and area fire
1
22
Any tgts on MI 2 (NS)
No
100
Yes
28
Kind = 0 do not fire
Yes
28
No
F1 (Kind) odd (PP tgts in x, y)
Yes
No
2888
Any MI 3 (EPP)
No
100
Yes
29
Final prot. fire
50 Not prog
No
F1 = 2 (kind an error)
Yes
740
120,140
Crew available for weapon
Yes
60
No
740


60
60
Set ITL array (EPP and LOS)
F1 odd (fire pp in designated sq)
No
Yes
70
Set ITL1 array (ITL and within n sqs of tgt sq)
72
Support fire
Yes
Direct fire
No
Yes
74
Tgts on ITL1
No
5
Yes
No
90
Tgts on ITL
No
740
94
F1 = 5,7 (pp in designated square)
No
Yes
96
Tgts on ITL1
No
Yes
80
ITL ← ITL1
150,152
Set: MT1 (fired at unit) MT2 (fired at friends) MT3 (neither, but EPP)
8
8
155–180
Get ranges to tgts on ITL.
Set MV1, MV2, and MX3 using index for vul. rnge brackets, MCVTS, MCVTM and tgt classes
MV1 – seriously vul.
MV2 – mod. vul.
MX3 – invul.
181–182
Use MV1, 2 and MT1, 2, 3 to set MX1 and MX2
MX1 – fired at unit and seriously or mod. vul.
MX2 – fired at unit or friends and seriously or mod. vul.
183
Tgts on MX1
No
Yes
184
Can unit call arty
No
Yes
185
Unit pinned down or partially neut.
No
Yes
186
MX ← MX1
CALL CLARTY
4
190
F2
Danger or opp first
Danger
Opp
290
CALL OPFRST
550
CALL DGFRST
6
7


7
Danger
608
NOTGT : 0
=
610
FI = PP tgts
Yes
620
Clear tgt info
No
ISIG = 1
3
≠
640
NOTGT : 2
≥
641, 644
Set MTL3 list from MLT2 and MV1 (MLT2 set in DG and OPFRST) and count tgts in NTGT
MTL2 · EPP, LOS, rnge, fired at unit, on prior list
<
3
Yes
F1 = PP in sq
=
6
Opp
NOTGTS : 0
No
ISIG = 1
360, 370
≠
CALL DESTGT
200
ISIG : 0 (support fire if ≠ 0)
740
=
3
≠
No
670
Yes
LOS
Direct fire
5
Yes
680
No
Get rnge
NTGT : 0
≠
=
Set MTL3 from MTL2 and MV2
Tgt on MX3 only
=
NTGT : 0
650
≠
MTL2 MTL3
Tgt sq in rnge and crew for wpn
No
Yes
IA = 1 (?) Pack tgt description; set aim (reaim), wpn clk, and code; turn area bit and aiming bit
700
Write history
735
Set tgt to zero; wpn clk = INFL
740
740
Pack tgt, wpn clk, and code and TATRIB
750
RETURN
100
100
Wpn busy
Yes
No
110
Zero tgt word; turn off area bit
740

Part III

THE POST PROCESSOR

The Post Processor reads the history file (Unit 4) produced by the Battle Model and, based on program otpions, produces output reports. See Appendices A and B for a description of the options.

Program BIGEST, Overlay (0,0), reads the input control cards, and stores the option selected in array OPTION. If the treatment being processed was a one replication game, the end treatment program ENDTRT, Overlay (3,0) is bypassed.

Overlay (1,0), HISTOR, reads the output tape (Tape 4) from the Battle Model in blocks of 500 words (100 messages), loads each message into the MSG array, and routes to the proper area for printing according to the event code (LOB).

A description of the variables and their settings are included later in this section. Also the LOB number, its program of origin, and the message contents are included.

Most labeled commons are either local or contain different arrays in different overlays. The arrays are listed indicating the labeled common which includes them, the overlays containing the labeled common, and the contents of the arrays.

Documentation and flow charts for TGTKIL (Overlay (1,1)), OPSTAT (Overlay (0,2)) and ENDTRT (Overlay (3,0)). Flow charts for begin and end replication logic of HISTOR follow.

Post Processor Variables

JEOT = 0, begin treatment; = 1, end treatment. Set in begin and end treatment section of HISTOR (Overlay (1,0)).

JEOR = 0, begin replication; = 1, end replication. Set in begin and end replication section of HISTOR.

NTREAT. Treatment number being processed. Loaded in begin treatment section of HISTOR.

NRPL. Replication number being processed. Loaded in begin replication section of HISTOR.

OPTCHK(6). Six output options are provided for. Only two HISTRY and SELHIS are used. Loaded by data statement in BLOCK DATA HSTDAT.

OPTION(6). The corresponding option selected in OPTCHK is set equal to one in BIGEST (Overlay (0,0)).

KFST = 1 from begin treatment message to end treatment message;

= 0 otherwise.

JBLUE, JRED. Number of blue and red weapon units initially. Loaded in begin treatment section, HISTOR, from tape 4.

MPGRID, MTIME, JDATE, NRPLS. Grid size, maximum battle time, date of run, number of replications to run. Loaded in begin treatment section, HISTOR, from tape 4.

BATEND = 0 if battle terminated due to maximum time; = 1 otherwise. Set initially to zero in BLOCK DATA HSTDAT.

LSTR. Last treatment to be processed. Input from control card, read in BIGEST.

RESPTF(2,7). Hollerith stored for printout. Loaded in BLOCK DATA HSTDAT.

NMSG. Number of words in history message. BLOCK DATA HSTDAT.

NOREP, NOTMT. Replication and treatment number whose history is to be printed. (See Appendixes A and B.)

ISEL(40). Side and units to be printed by selective history. Input from card, see Appendixes A and B.

PRINT = 0, do not print the message being processed; = 1, print the message. This is set at statements 360 and 361 in the begin replication section of HISTOR.

Event History Messages

Event Code (LOB)	Message origin	Message
1	Move select (MOVE)	Squares moving from and to, time from center to boundary of square, velocity.
2	Boundary crossing (BOUNDX)	Square moved from, time to move boundary to center of new square, velocity, concealment, cover, net cover, and line-of-sight after move.
3	Intelligence report (first line) (TGTACQ)	Number of enemy units known dead, in line-of-sight, in sensor range, not concealed if in line of sight, and number of enemy units pinpointed, erroneously pinpointed, known to nearest square both before and after the surveillance. (Message from target acquisition.)
4	Impact firer (IMPACT)	Firing weapon number, target number, hit probability, kill probability, number of rounds, firer dead prior to impact.
5	Impact firer (IMPACT)	Firing weapon number, target number, hit probability, kill probability, number of rounds, reload time.
6	Impact firer (Reload after impact) (IMPACT)	Firing weapon number, target number, hit probability, kill probability, number of rounds, number of hits.
7	Impact target (IMPACT)	Firing weapon number, firing unit, vehicles before and after, troops before and after.
8	Firing with reload time (FIRING)	Firing weapon number, target number, range, time of flight, reload time.
9	Firing (FIRING)	Firing weapon number, target number, range, time of flight.
10	New Mission (NEWMIS)	New order number, octal representation of mission word.
11	Battle terminated due to casualties (STOP2)	Side that caused termination, casualty limit, number of casualties.

Event Code (LOB)	Message origin	Message
12	Battle terminated due to proximity of forces (STOP1)	Side that caused termination, location indicated for proximity, number of units within designated range.
13	Target select (DESTGT)	Weapon number that made selection, target selected, target location, aim time, ammo type to be used.
14	Area target selected (TGTSEL)	Weapon number that made selection, area location, aim/reaim time.
15	Intelligence report (second line) (TGTACQ)	Bit patterns of enemy units, units known to nearest square, erroneous pinpoint, and pinpoint.
16	Artillery called (CLARTY)	Responding weapon number, responding unit number, target area location, aim time, target number, ammo type.
17	Dismount (BDMONT)	Carrier unit number, dismounting unit number, number of vehicles in carrier unit, number of men dismounting, dismount time.
18	Response to fire (RESPNS)	Total rounds received, total direct fire, total indirect fire, suppression status.
19	Out of ammunition (FIRING)	Weapon number which fired last of ammo.
20	Begin treatment (MAIN2X)	No message printed.
21	Begin replication (MAIN2X)	No message printed.
22	End replication (MAIN2X)	No message printed.
23	End treatment (MAIN2X)	No message printed.
24	Firing (FIRING)	Suppressive fire, Firing weapon number, target number, range, time of flight, reload time.
25	Firing (FIRING)	Suppressive fire. Firing weapon number, target number, range, time of flight.
26	Intelligence report (third line) (TGTACQ)	Bit pattern of enemy units in line of sight, known dead, and under surveillence (if restricted).

Event Code (LOB)	Message origin	Message
27	Impact area fire (IMPACT)	Firing weapon number, target number, hit probability, kill probability, number of rounds, reload time.
28	Impact area fire (IMPACT)	Firing weapon number, target number, hit probability, kill probability, number of rounds, number of hits.
29	Impact target (artillery) (IMPACT)	Firing weapon number, firing unit number, vehicles and troops in target unit before and after impact.
30	Not used	
31	Mount (BMOUNT)	Mounting unit number, number of vehicles in carrier unit, number of men mount)ing, mount (remount) time.
32	Battle terminated due to vehicle losses (STOP3)	Side that caused termination, vehicle casualty limit, number of vehicle casualties.
33	Helicopter called (CLHCPR)	Helicopter unit number, target unit number, target location, altitude.
34	Not used	
35	Position disclosure (POSDIS)	Bit pattern of enemy units intelligence change on firer, no info to erroneous pinpoint, erroneous pinpoint to pinpoint.
36	Change altitude (CHGVRT)	New altitude, new line of sight.

Arrays, Their Contents, Labeled Common, and Overlays

/LNK1/MRD(13,48,2) (Information, unit, side)

Used by: HISTOR, TGTKL, OPSTAT
(1,0), (1,1), (1,2)

Information indices:

1 - original X-coordinate
2 - original Y-coordinate
3 - original altitude
4 - current (final) X-coordinate
5 - current (final) Y-coordinate
6 - current (final) altitude
7 - number of moves (from BOUNDX message)
8 - rounds fired (from FIRING message)
9 - rounds received (from IMPACT-FIRER message)
10 - original number of men
11 - current (final) number of men
12 - original number of vehicles
13 - current (final) number of vehicles

This array is printed in order in replication summary.

/LNK1/SUPPLY (21,48,2)

Used by: HISTOR, TGTKL, OPSTAT
(1,0),(1,1),(1,2)

Weapon and ammo information in the order as printed in replication summary. The 21 words of information are unit number, and 5 words for each of four possible weapon types— the weapon number, ammo type 1 begin and end, ammo type 2 begin and end.

/LNK1/IREPR(56,32,2)

Used by: HISTOR, TGTKL, OPSTAT
(1,0),(1,1),(1,2)

(Weapon type, alternating men and vehicles killed by target class, side)

/T1/ KWRT(56,32)

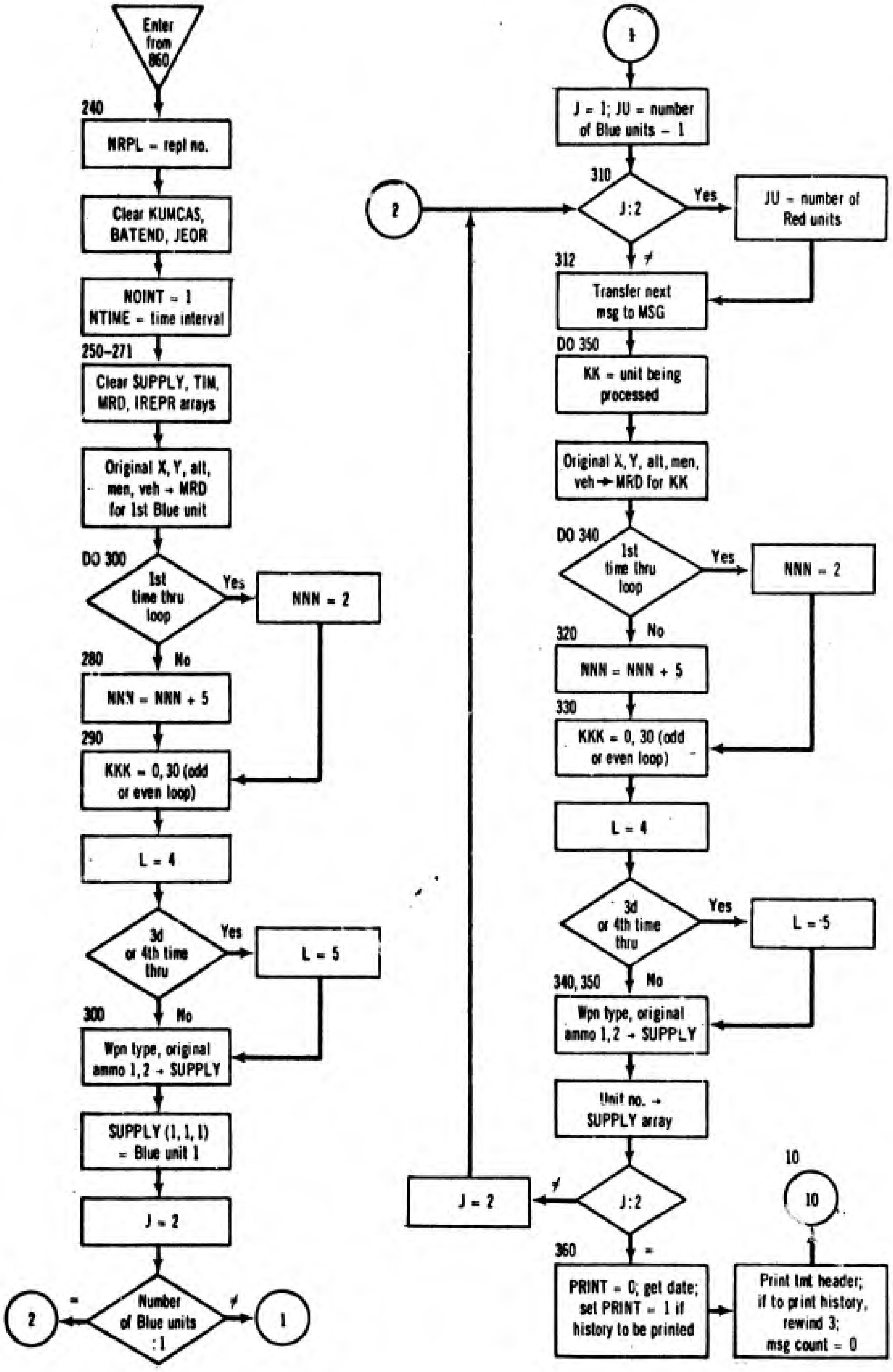
Used by: TGTKL
(1,1)

IREPR for side being processed. In this array the weapon type numbers are the first index, while ascending they are not necessarily consecutive, and all blanks are trailing. This array is assembled starting

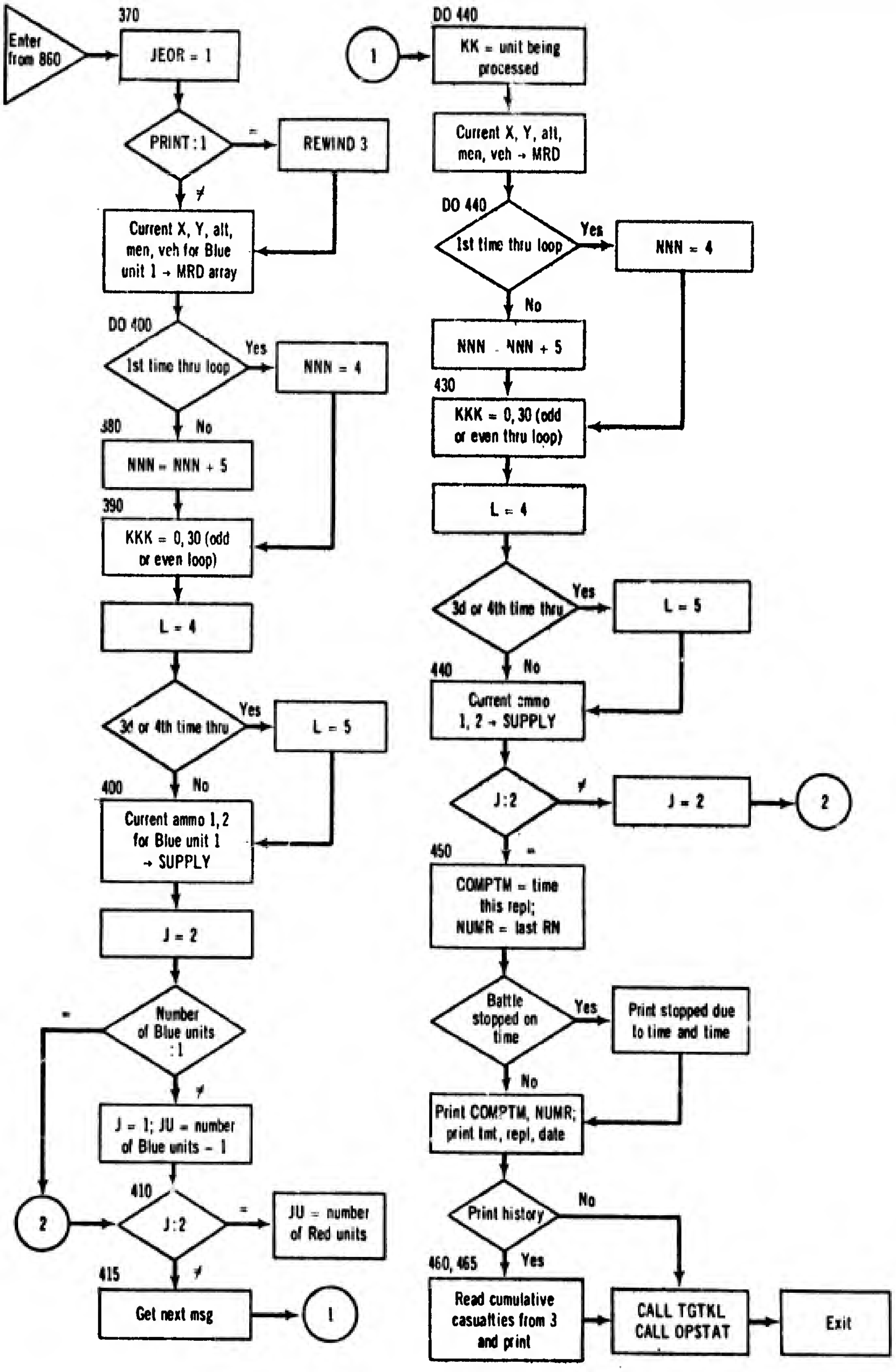
	at statement 80 and in the DO 150, DO 120, and DO 140 loops in TGTKL (Overlay (1,1)).
/T1/JWRT(56)	
Used by: TGTKL (1,1), See /T3/	The weapon type numbers correspond to KWRT. Blanks are trailing. Used for output in TGTKL.
/T1/IREPRT(32)	
Used by: TGTKL (1,1)	Totals by target classes, alternating men and vehicles from KWRT. Output in TGTKL.
/T1/TOTMEN(56), TOTVEH(56)	
Used by: TGTKL (1,1)	Total kills by weapon type. Printed at DO 230 in TGTKL.
/LNK1/TIM(48,2)	
Used by: HISTOR, TGTKL, OPSTAT (1,0),(1,1),(1,2)	Unit death time.
/RWRB/AVG(56,32,2), VSQ(56,32,2)	
Used by: HISTOR, TGTKL (1,0),(1,1)	Sums for average and variance of kills corresponding to IREPR. AVG accumulated at beginning of TGTKL, VSQ at DO 240 of TGTKL.
/T1/MTOTAL(6,2)	
Used by: OPSTAT (1,2)	Total MRD rounds fired, received; troops initial, final; vehicles initial, final.
/T1/STOTAL(56,2)	
Used by: OPSTAT (1,2)	Ammo expenditures by weapon type and ammo type for side being processed. Output in OPSTAT (Overlay (1,2)).
/PATTY/KTOTAL(56,2,2)	
Used by: HISTOR, TGTKL, OPSTAT (1,0),(1,1),(1,2)	Weapon type, ammo type, side. Sum of STOTAL indexed by side. DO 90 in OPSTAT.

AMMOAV(56,2,2) (Dimension only)	
Used by: ENDTRT (3,0)	KTOTAL floated, then averaged by replication. DO 330 in ENDTRT.
/PATTY/NTOTAL(56,15,2)	
Used by: HISTOR, TGTKL, OPSTAT (1,0),(1,1),(1,2)	Average ammo expenditure for treatment by time interval. (Weapon type, time interval, side.) See Appendixes A and B for output selection.
/PATTY/AMMOVS(56,2,2)	
Used by HISTOR, TGTKL, OPSTAT (1,0),(1,1),(1,2)	Used for ammo expenditure variance computation and output. (Weapon type, ammo type, side.)
/T3/WARAY(56,32)	
Used by: ENDTRT (3,0)	Average or variance of target kills by weapon type. Loop DO 240 computes averages and variances separately. (Weapon type, alternate men and vehicles by target type.)
/T3/REPRT(32)	
Used by: ENDTRT (3,0)	Totals of WARAY for weapon type being processed.
/T3/JWRT(56)	
Used by: ENDTRT (3,0)	The weapon type numbers correspond to KWRT. Blanks are trailing. Used for output in TGTKL.

HISTOR BEGIN REPL


Enter from 860
240
NRPL = repl no.
Clear KUMCAS, BATEND, JEOR
NOINT = 1
NTIME = time interval
250-271
Clear SUPPLY, TIM, MRD, IREPR arrays
Original X, Y, alt, men, veh → MRD for 1st Blue unit
DO 300
1st time thru loop
Yes
NNN = 2
280
No
NNN = NNN + 5
290
KKK = 0, 30 (odd or even loop)
L = 4
3d or 4th time thru
Yes
L = 5
300
No
Wpn type, original ammo 1, 2 → SUPPLY
SUPPLY (1, 1, 1) = Blue unit 1
J = 2
2
=
Number of Blue units :1
≠
1
1
J = 1; JU = number of Blue units − 1
310
2
J:2
Yes
JU = number of Red units
312
≠
Transfer next msg to MSG
DO 350
KK = unit being processed
Original X, Y, alt, men, veh → MRD for KK
DO 340
1st time thru loop
Yes
NNN = 2
320
No
NNN = NNN + 5
330
KKK = 0, 30 (odd or even loop)
L = 4
3d or 4th time thru
Yes
L = 5
340, 350
No
Wpn type, original ammo 1, 2 → SUPPLY
Unit no. → SUPPLY array
J = 2
≠
J:2
10
10
360
=
PRINT = 0; get date; set PRINT = 1 if history to be printed
Print lmt header; if to print history, rewind 3; msg count = 0

HISTOR END REPL


Enter from 860
370
JEOR = 1
PRINT : 1
=
REWIND 3
≠
Current X, Y, alt, men, veh for Blue unit 1 → MRD array
DO 400
1st time thru loop
Yes
NNN = 4
380
No
NNN = NNN + 5
390
KKK = 0, 30 (odd or even loop)
L = 4
3d or 4th time thru
Yes
L = 5
400
No
Current ammo 1, 2 for Blue unit 1 → SUPPLY
J = 2
Number of Blue units : 1
=
≠
J = 1; JU = number of Blue units − 1
410
2
J : 2
=
JU = number of Red units
415
≠
Get next msg
1
1
DO 440
KK = unit being processed
Current X, Y, alt, men, veh → MRD
DO 440
1st time thru loop
Yes
NNN = 4
No
NNN = NNN + 5
430
KKK = 0, 30 (odd or even thru loop)
L = 4
3d or 4th time thru
Yes
L = 5
440
No
Current ammo 1, 2 → SUPPLY
J : 2
≠
J = 2
2
450
=
COMPTM = time this repl; NUMR = last RN
Battle stopped on time
Yes
Print stopped due to time and time
No
Print COMPTM, NUMR; print tmt, repl, date
Print history
No
460, 465
Yes
Read cumulative casualties from 3 and print
CALL TGTKL CALL OPSTAT
Exit

TGTKL, Overlay(1,1)

If this overlay is entered from HISTOR in the impact target section, men and vehicle kills are accumulated in IREPR, for output in this program, and AVG for average output at end of treatment if there is more than one replication. Kills in these arrays are by target class, alternating men and vehicles. Control then returns to HISTOR, Overlay (1,0).

The routine is also entered at the end of the end replication section of HISTOR. The report array, IREPRT, and the arrays TOTMEN, TOTVEH, and the variables ITOTM and ITOTV are cleared (DO 30 and DO 40).

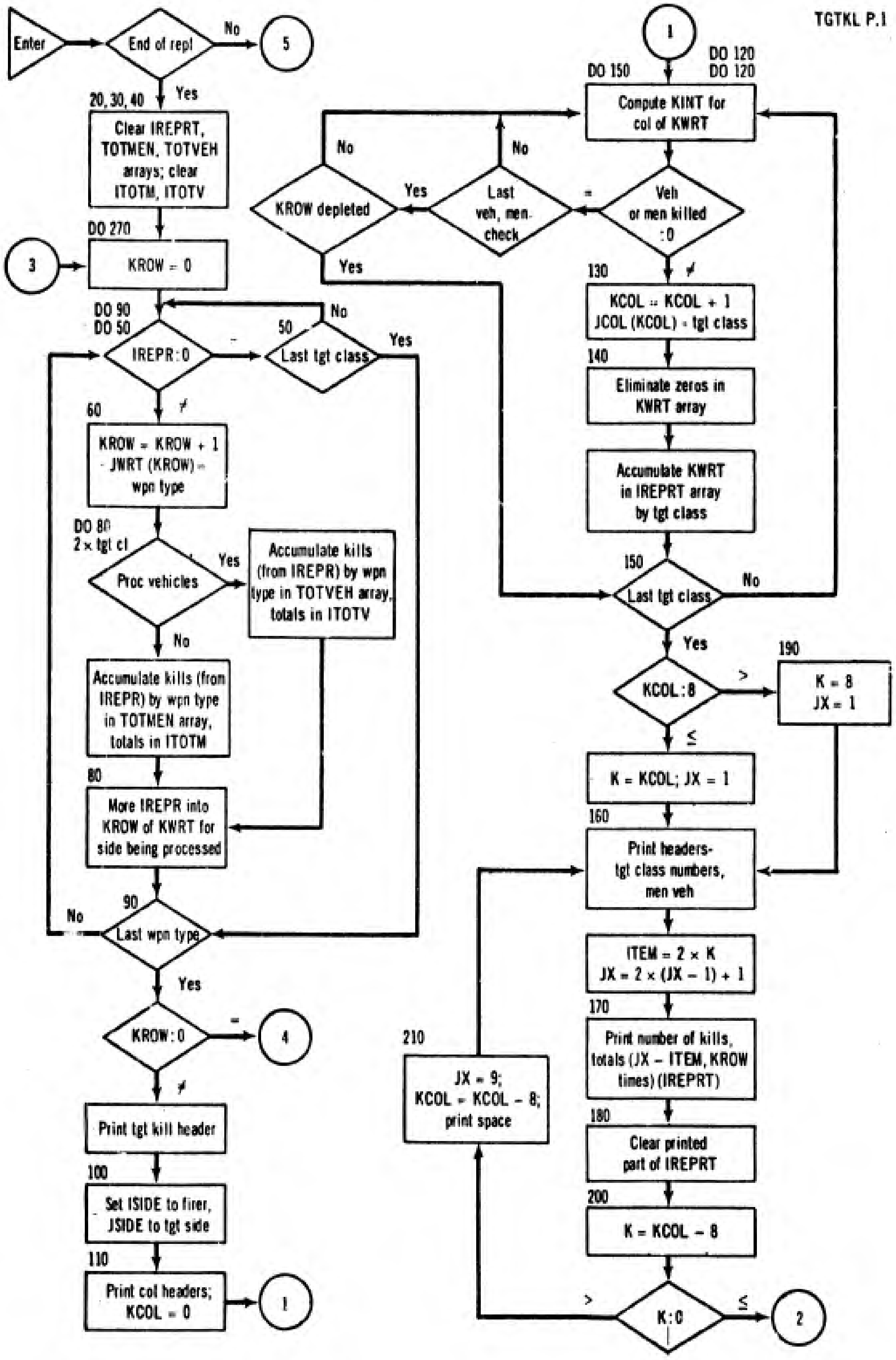
The array JWRT is constructed to contain the weapon type numbers which caused casualties in ascending order. Accumulation is made into TOTMEN, TOTVEH arrays, and ITOTM, ITOTV. The KWRT array is then loaded from non-zeros of IREPR for the side being processed (DO 90, DO 50, DO 80).

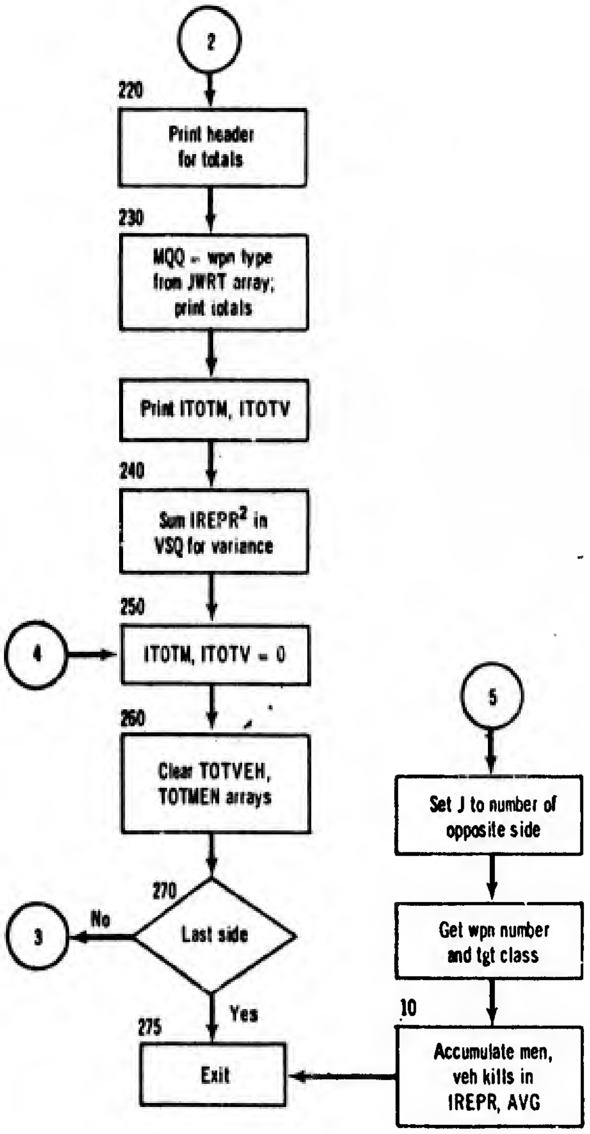
The DO 150, DO 120 and DO 140 loops eliminate zero columns in KWRT and accumulate totals in IREPRT by target class. (The M in the inner DO 120 is for alternating men and vehicles.)

At statement 150, K is set to the number of columns to be printed (maximum 8 double columns in ITEM). JX is set for the beginning index of IREPRT in case more than one line is to be printed. DO 170 prints the rows of the report. DO 180 clears the printed section of IREPRT. If another row is necessary (more than 8 target classes), ITEM and JX are set and the line printed.

The totals table is then printed in the DO 230 loop. The IREPR^2 are accumulated into the VSQ array for later computation of variance. ITOTM, ITOTV, TOTMEN, TOTVEH are cleared and the side red is processed. Control then returns to HISTOR, Overlay (1,0).

TGTKL P.1


Enter
End of repl
No
5
Yes
20, 30, 40
Clear IREPRT, TOTMEN, TOTVEH arrays; clear ITOTM, ITOTV
DO 270
3
KROW = 0
DO 90
DO 50
No
50
Yes
IREPR: 0
-
Last tgt class
60
≠
KROW = KROW + 1 JWRT (KROW) = wpn type
DO 80
2 × tgt cl
Proc vehicles
Yes
Accumulate kills (from IREPR) by wpn type in TOTVEH array, totals in ITOTV
No
Accumulate kills (from IREPR) by wpn type in TOTMEN array, totals in ITOTM
80
More IREPR into KROW of KWRT for side being processed
90
No
Last wpn type
Yes
KROW: 0
=
4
≠
Print tgt kill header
100
Set ISIDE to firer, JSIDE to tgt side
110
Print col headers; KCOL = 0
1
1
DO 120
DO 120
DO 150
Compute KINT for col of KWRT
No
No
Yes
KROW depleted
Last veh, men check
=
Veh or men killed :0
Yes
130
≠
KCOL = KCOL + 1 JCOL (KCOL) = tgt class
140
Eliminate zeros in KWRT array
Accumulate KWRT in IREPRT array by tgt class
150
Last tgt class
No
Yes
190
KCOL: 8
>
K = 8 JX = 1
≤
K = KCOL; JX = 1
160
Print headers- tgt class numbers, men veh
ITEM = 2 × K JX = 2 × (JX − 1) + 1
170
Print number of kills, totals (JX − ITEM, KROW times) (IREPRT)
210
JX = 9; KCOL = KCOL − 8; print space
180
Clear printed part of IREPRT
200
K = KCOL − 8
>
K: 0
≤
2


2
220
Print header for totals
230
MQQ = wpn type from JWRT array; print totals
Print ITOTM, ITOTV
240
Sum IREPR² in VSQ for variance
250
4
ITOTM, ITOTV = 0
260
Clear TOTVEH, TOTMEN arrays
270
Last side
No
3
Yes
275
Exit
5
Set J to number of opposite side
Get wpn number and tgt class
10
Accumulate men, veh kills in IREPR, AVG

OPSTAT, Overlay (1,2)

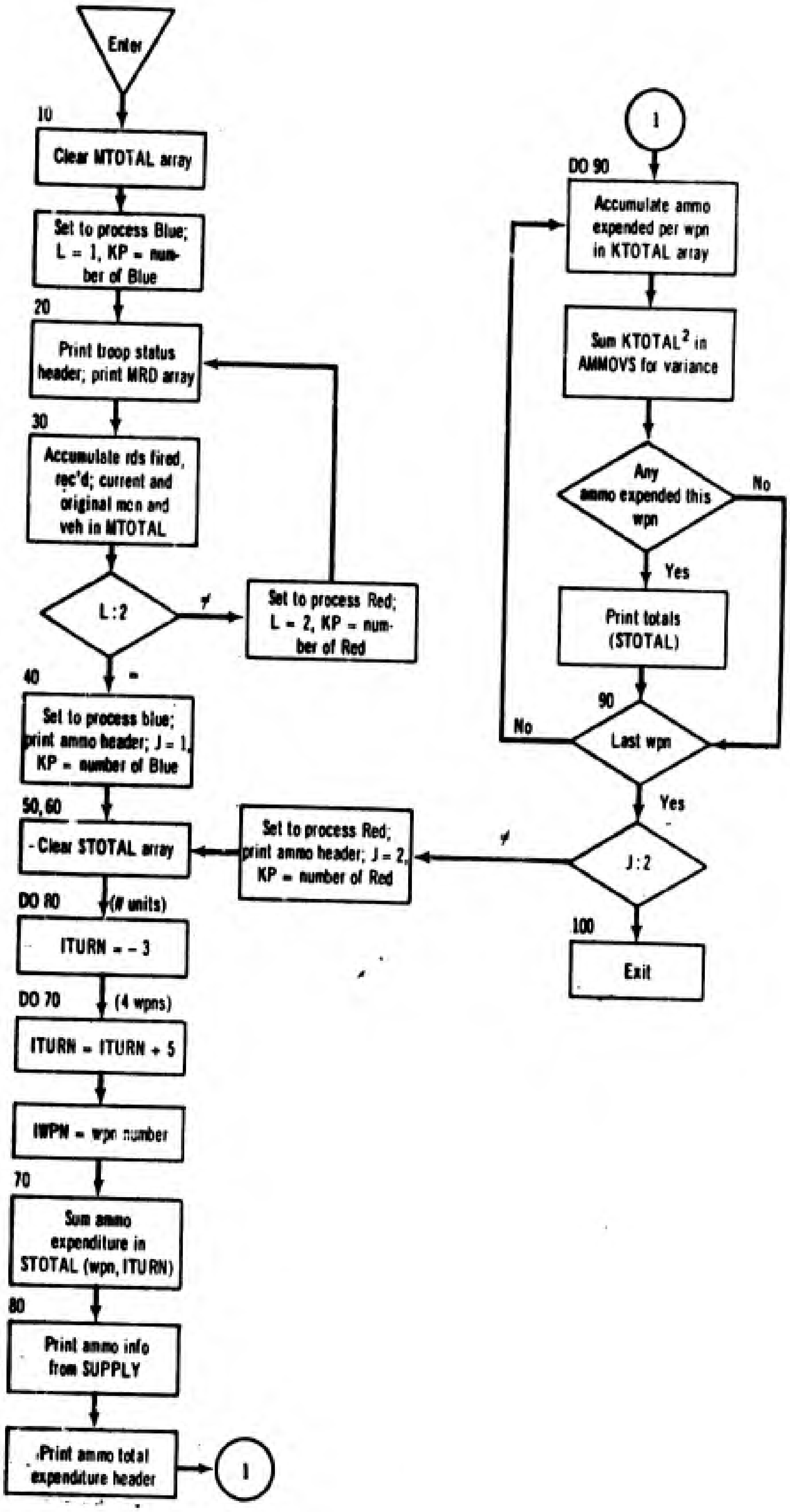
The MTOTAL array is cleared. The MRD and TIM arrays are printed. MTOTAL is accumulated and printed for blue (DO 30). The process is repeated for red.

The weapon and ammo expenditure array (SUPPLY) is then processed. First the STOTAL array is cleared (DO 60). Ammo expenditure by weapon type and ammo type are accumulated from the array SUPPLY into STOTAL and the SUPPLY array is printed (DO 80).

STOTAL for each weapon type and ammo type is accumulated into KTOTAL for each side. STOTAL^2 for each wpn type and ammo 1 and 2 is accumulated into AMMOVS for ammo variance computation later (DO 90).

Total ammo expenditure is then printed from STOTAL.

After both sides have been processed control returns to HISTOR Overlay (1,0).


Enter
10
Clear MTOTAL array
Set to process Blue; L = 1, KP = number of Blue
20
Print troop status header; print MRD array
30
Accumulate rds fired, rec'd; current and original men and veh in MTOTAL
L:2
≠
Set to process Red; L = 2, KP = number of Red
=
40
Set to process blue; print ammo header; J = 1, KP = number of Blue
50,60
Clear STOTAL array
DO 80
(# units)
ITURN = -3
DO 70
(4 wpns)
ITURN = ITURN + 5
IWPN = wpn number
70
Sum ammo expenditure in STOTAL (wpn, ITURN)
80
Print ammo info from SUPPLY
Print ammo total expenditure header
1
1
DO 90
Accumulate ammo expended per wpn in KTOTAL array
Sum KTOTAL^2 in AMMOVS for variance
Any ammo expended this wpn
No
Yes
Print totals (STOTAL)
90
No
Last wpn
Yes
J:2
≠
Set to process Red; print ammo header; J = 2, KP = number of Red
100
Exit

ENDTRT, Overlay(3,0)

Arrays REPRT, WARAY, JWRT and JCOL (common T3) are cleared (DO 10 and DO 11). X is set equal to the number of replications.

The DO 240 loop is on JJO. JJO = 1, 2 for averages blue, red; = 3, 4 for variances blue, red. DO 20 computes variances and averages and stores them in arrays VSQ and AVG. The averages or variances for the side are stored in WARAY. (The target class kills, alternating men and vehicles.) DO 150, DO 140, eliminate zero columns and rows in WARAY and accumulate in REPRT. (Compare with TGTKL and ENDTRT flow chart.) DO 180 prints the averages or variances for the side being processed. Statements 200, 210, and 220 set up for a second line if necessary (more than 8 target classes).

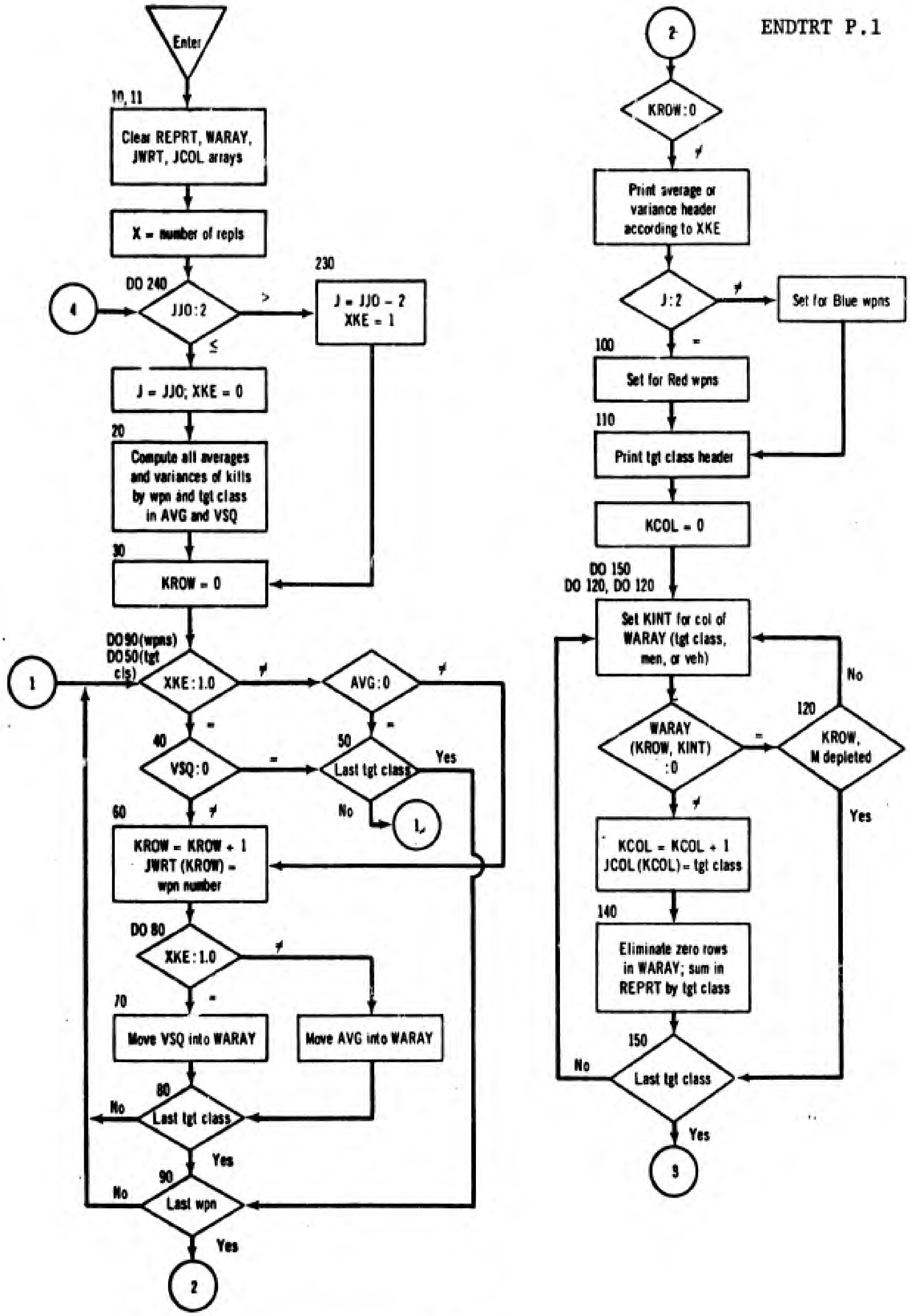
The DO 380 loop moves KTOTAL into AMMOAV (average ammo expenditure). Variance of ammo expenditure for both ammo types for each weapon type is computed and stored in AMMOVS. The average is computed and stored in AMMOAV and printed (DO 330). The variance is printed at DO 530.

If INTTIM equals zero ammo expenditure by time interval was not requested, and control returns to BIGEST, Overlay (0,0).

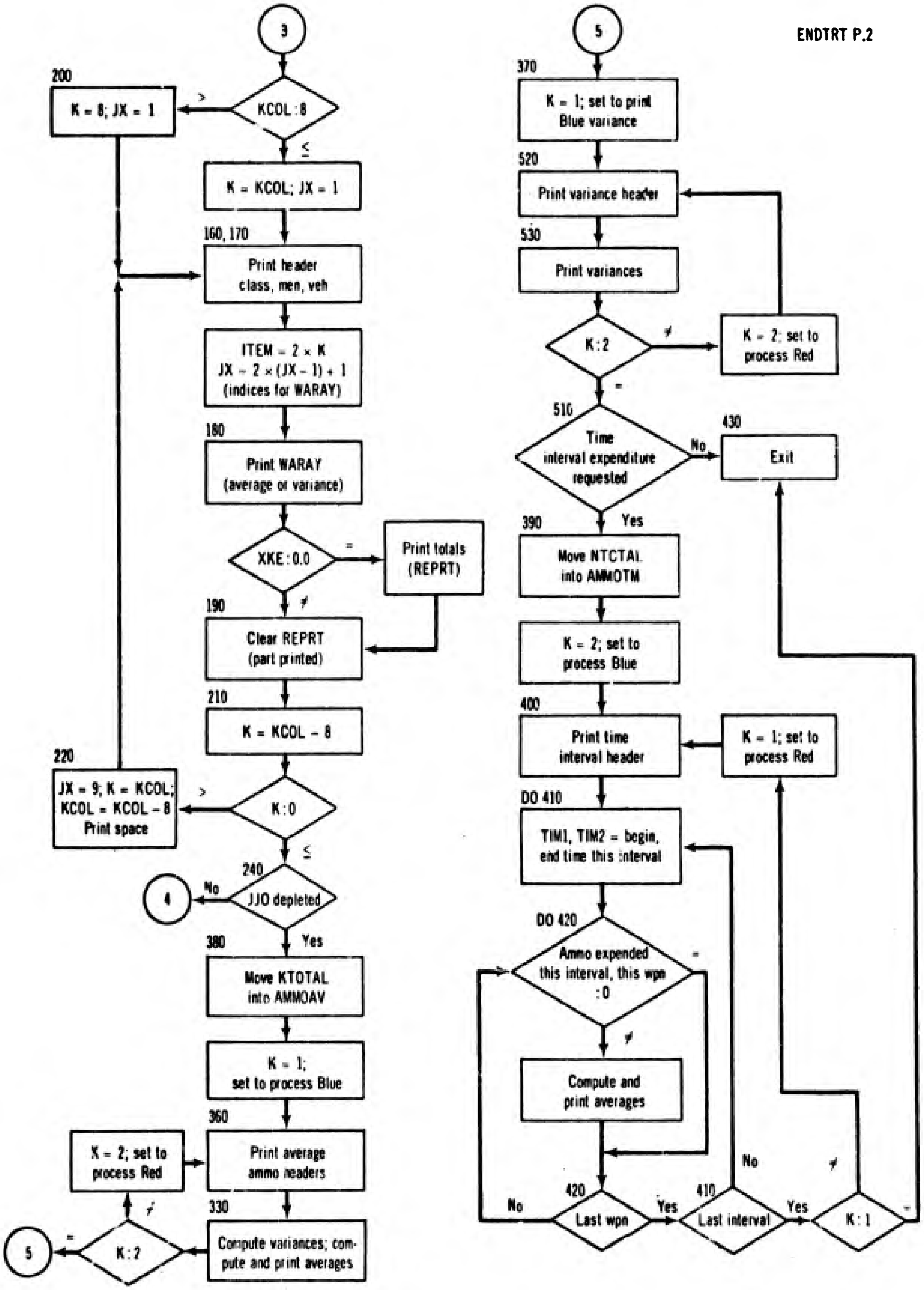
If expenditure by time interval was requested the array NTOTAL is moved into AMMOTM.

The DO 410 loop computes the beginning and ending times for the time interval in TIM1 and TIM2 and DO 420 computes and prints the averages for the time interval. After both sides have been processed control returns to BIGEST, Overlay (0,0).

ENDTRT P.1



Enter
10, 11
Clear REPRT, WARAY, JWRT, JCOL arrays
X = number of repls
DO 240
4
JJO : 2
>
230
J = JJO − 2
XKE = 1
≤
J = JJO; XKE = 0
20
Compute all averages and variances of kills by wpn and tgt class in AVG and VSQ
30
KROW = 0
DO 90(wpns)
DO 50(tgt cls)
1
XKE : 1.0
≠
AVG : 0
≠
=
=
40
VSQ : 0
=
50
Last tgt class
Yes
No
1
60
≠
KROW = KROW + 1
JWRT (KROW) = wpn number
DO 80
XKE : 1.0
≠
70
=
Move VSQ into WARAY
Move AVG into WARAY
80
No
Last tgt class
Yes
90
No
Last wpn
Yes
2
2
KROW : 0
≠
Print average or variance header according to XKE
J : 2
≠
Set for Blue wpns
100
=
Set for Red wpns
110
Print tgt class header
KCOL = 0
DO 150
DO 120, DO 120
Set KINT for col of WARAY (tgt class, men, or veh)
No
120
WARAY (KROW, KINT) : 0
=
KROW, M depleted
≠
Yes
KCOL = KCOL + 1
JCOL (KCOL) = tgt class
140
Eliminate zero rows in WARAY; sum in REPRT by tgt class
150
No
Last tgt class
Yes
3


3
200
K = 8; JX = 1
>
KCOL : 8
≤
K = KCOL; JX = 1
160, 170
Print header
class, men, veh
ITEM = 2 × K
JX = 2 × (JX − 1) + 1
(indices for WARAY)
180
Print WARAY
(average or variance)
XKE : 0.0
=
Print totals
(REPRT)
≠
190
Clear REPRT
(part printed)
210
K = KCOL − 8
220
JX = 9; K = KCOL;
KCOL = KCOL − 8
Print space
>
K : 0
≤
240
No
4
JJO depleted
Yes
380
Move KTOTAL
into AMMOAV
K = 1;
set to process Blue
360
K = 2; set to
process Red
Print average
ammo headers
≠
330
5
=
K : 2
Compute variances; compute and print averages
5
370
K = 1; set to print
Blue variance
520
Print variance header
530
Print variances
K : 2
≠
K = 2; set to
process Red
=
510
Time
interval expenditure
requested
No
430
Exit
Yes
390
Move NTCTAL
into AMMOTM
K = 2; set to
process Blue
400
Print time
interval header
K = 1; set to
process Red
DO 410
TIM1, TIM2 = begin,
end time this interval
DO 420
Ammo expended
this interval, this wpn
: 0
=
≠
Compute and
print averages
No
≠
420
No
Last wpn
Yes
410
Last interval
Yes
K : 1
=

Appendix A

CDC 6400 RUNNING GUIDE AND DATA STORAGE

First Preprocessor

Input Cards. Two types of inputs are used: (1) to initialize (or install) a father (and son or sons) treatment and (2) to update (or change) the input tape 3 to the second preprocessor. The run control and header identification are entered in cols 73-76 and numerical identification, if any, in cols 77-80. For (1) above the first identification is CARD followed by INST nnnn, where nnnn is the treatment number. Each input data set must be preceded by its identification (for example MISN) card. The last card for each treatment is END or ENDP. This may be followed by the INST nnnn and identification cards for other treatments (the sons).

For (2) the identification is UPDA, followed by CHGE nnnn where nnnn is the treatment in which changes occur. Only cards for changes or additions to the input are included.

In each case the identification for the end of input is FINI.

Tape 3. Output tape which is input to the second preprocessor. This tape will contain labeled commons MAIN and INTER, whose lengths are stored in KONTRL (1) and (2), respectively, in BLOCK DATA STORAGE.

Tape 2. The Tape 3 (output) from a previous first preprocessor run. It is used as input if the previous input is to be updated. If updating is not required for the father or all of the sons the CHGE card should be followed immediately by the END card.

The END card will suppress the printing of the treatment data to be processed. To obtain the printout an ENDP card should be used.

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Second Preprocessor

Tape 3. The input tape. This is the output from the first preprocessor.

Tape 2. The output tape. This is the input for the Battle Model. It contains the labeled common CMAIN, the length of which is stored in NWPERM in BLOCK DATA BATTLE in the Battle Model, and in NWPERM in BLOCK DATA DEFINE in the second preprocessor.

Card input is a single run option card. A zero (0) in column 2 will suppress the printing of the diagnostic treatment data. A one (1) will permit printing. Columns 4-5 is the number of backgrounds between 1 and 16. If the printing of only one treatment is desired, the treatment number is entered in cols 7-10. Columns 7-10 blank will print diagnostic data for all treatments.

The Battle Model

Tape 2. The input tape. This is the output from the second preprocessor.

Tape 4. The output tape. This tape contains the history event messages written during the running of the Battle Model.

Run Parameter Cards. The run parameters for each treatment are on separate cards. This card also controls the turning on of the debug feature. All numbers are decimal and right-adjusted in their fields.

Cols 1-3	maximum minutes of battle time per replication
Cols 4-5	the number of replications to play
Cols 6-16	the seed for the first random number
Cols 17-20	treatment number to play
Cols 21-22	"X" coordinate on the battlefield
Cols 23-24	"Y" coordinate on the battlefield
Cols 25-28	a distance in meters
Col 29	a side either 1-Blue or 2-Red
Col 30	the number of units

The last five fields above will cause the battle to terminate if more than the specific number of units of the given side reach the distance to the given square.

Cols 31-34* the number of Red casualties to stop game

Cols 35-38* the number of Blue casualties to stop game

Cols 41-42 indicator, if non-zero the debugging switch is turned on

Cols 43-47 beginning time for debugging printing

Cols 48-52 ending time for debugging printing

In the last two fields above, the numbers are scaled 2^6 and converted to decimal.

Cols 53-55* the number of red vehicle casualties to stop game

Cols 56-58* the number of blue vehicle casualties to stop game

The last run parameter card must have the following:

Cols 1-16 blank

Cols 17-20 9999

Cols 21-80 blank

The Post Processor

Tape 4. The input tape. This is the history tape that was written during the battle simulation.

Input Parameter Cards. The first card contains a 1 in col 1 if any output other than a summary is desired for each replication. If only the summary(ies) is required a zero goes in col 1. There are two output options now available, History and Selective History. If History or Selective History is desired cols 2-5 contain the last treatment number to be processed. Cols 9 and 10 contain the replication whose history is to be printed. A 99 entered in this field will cause the history of all replications to be printed. Columns 12 to 15 contain the treatment number whose replication(s) are to be printed. If this contains a zero (or blank) the history of the specified replication(s) of all treatments will be printed.

---

*Optional

An integer entered in col 20 will give the average ammunition expenditure by weapon type for both sides for multiple replication runs for the time intervals specified by the integer. If col 20 is blank this information is not printed. However, output has been added to give average and variance of ammunition expenditure by weapon type for each side. If the history output is desired a second card with HISTRY in cols 1-6 is required.

If the second card is SELHIS, selective history output will be printed. In this a third card is necessary with a maximum of 40 two digit fields. These fields indicate the side and unit number, alternating, for units whose history is to be recorded.

If col 1 of the first input card is zero, the other cards should be omitted.

The Range Interval Post Processor

This program lists the number of engagements (firings), number of rounds fired, troop and vehicle casualties for each weapon on both sides, for all target classes that were engaged, in range intervals of a specified number of meters. Total accumulated casualties are then listed by range interval from the longest to the nearest range. The average for all replications of the treatment follow. The listing is for each replication of each treatment.

Tape 4. The input tape. The history tape from the Battle Model.

Input card lists the last treatment number to be processed in cols 2-5, the range interval desired in cols 7-10.

After all inputs for the CARMONETTE programs have been determined to be satisfactory, the Battle Model and the post processor can be run as a job stream in a single run to decrease turnaround time. The maximum number of magnetic tape will be two on the job card. The Battle Model binary tape is copied onto a disc file, and then the binary tape unloaded. The requests for tapes 2 and 4 follow. At the end of the Battle Model run tape 2 is unloaded and tape 4 rewound. Loading and running of the post processor binary tape is then requested. The field length should be varied to be kept at the minimum required using RFL cards. (In Scope 3.4 the RFL cards are not used.)

The line count should be indicated when the binary tape for either preprocessor or post processor is loaded; example, BIN (LC=XXXXXX), PL for Scope 3.4, where X is an octal number. Normally 60,000 for each treatment listed for each preprocessor is sufficient. For the post processor 100,000 lines for a 50-minute battle for each treatment is sufficient. (A system change may change this proceedure.)

The Pinpoint Post Processor

This program lists the number of times of occurrence of each number of pinpoints for both Blue and Red in specified time intervals, and the number of times and the number of units which detected the same target, both Blue and Red for the same time interval. The listing is for each replication of each treatment. In each case the percentage of the total is also printed.

Tape 4. The input tape. The history tape from the Battle Model.

Input Parameter Card. Columns 2-5 the last treatment to be processed, cols 6-10 the time interval, scaled 2^6, desired for output, and cols 11-15 the scan time, also scaled 2^6. All fields are integer and right adjusted. After reading, the times are further scaled 2^{12}. Thus for time interval of 5 minutes and scan time 1 minute the inputs would be 320 and 64.

Service Routines

Subroutine RWTAPE. RWTAPE is a FORTRAN subroutine to handle binary tapes. It provides read, write, backspace, skip, write file mark, and rewind facilities. Calls to RWTAPE for a particular file should not be mixed with FORTRAN I/O on the same file. RWTAPE has six entry points which are explained below.

Call RBT. To read binary a logical record of N central memory words,

```
CALL RBT (fstloc, no. words, file no.)
```

where "fstloc" is the first location of a contiguous area that the data are to be read into, "no. words" is the number, N, of central memory words to be read, and "file no." is the number of one of the files that is defined on a REQUEST card and on the PROGRAM card. The file definitions must be of the form TAPEx or TAPExx, where x is 1 to 9 and xx is 01 to 99. No other file definition will work. In all the calls, the number x or xx is substituted for the parameter "file no."

Call WBT. To write binary a logical record of N central memory words,

Call REPOS. To backspace the file N logical records,

CALL REPOS (dummy, no. logical, file no.)

where "dummy" is an unused but required parameter, "no. logical" is the number of logical records to be backspaced and "file no." is as before.

Call WFMK. To write a file mark,

CALL WFMK (dummy, dummy, file no.)

Call RWNDT. To rewind the file,

CALL RWNDT (dummy, dummy, file no.)

Call RBT. To skip one logical record,

CALL RBT (dummy, 0, file no.)

The system flow is shown in Fig. A1.

Utility Routines

The following seven routines are coded in the CDC 6000 series machine language COMPASS and perform packing, bit setting, and bit testing operations.

All seven functions employ the same bit numbering convention. Bits are numbered from 1 to 60, counting the bits from right to left, as shown below.

60, 59, 58, ... 3, 2, 1

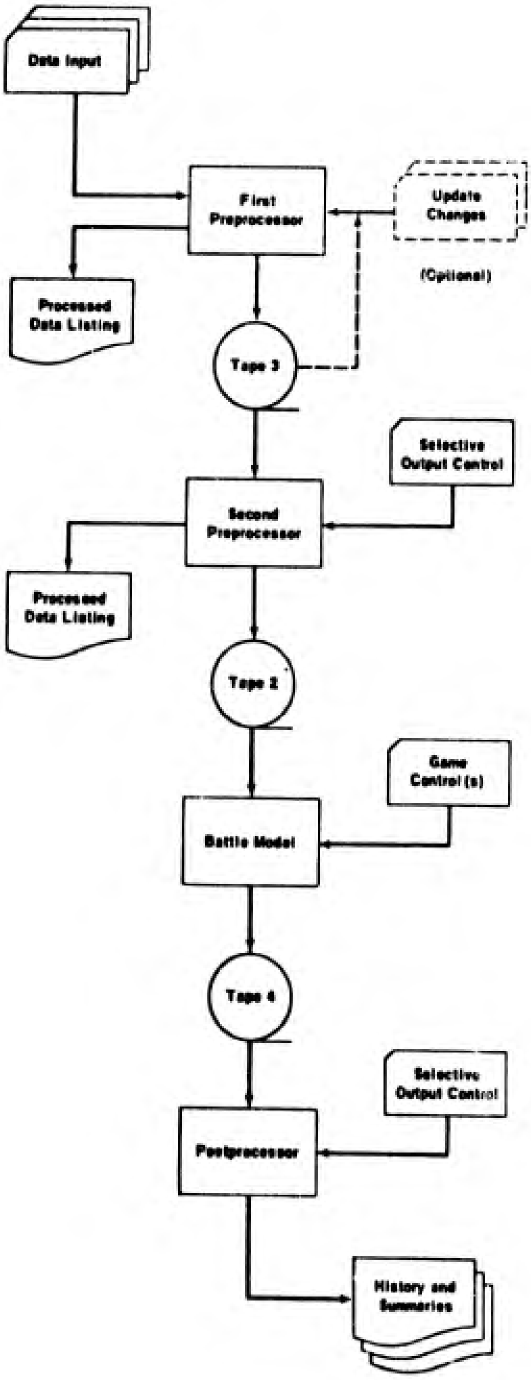
Data Input
First Preprocessor
Update Changes
(Optional)
Processed Data Listing
Tape 3
Selective Output Control
Second Preprocessor
Processed Data Listing
Tape 2
Game Control(s)
Battle Model
Tape 4
Selective Output Control
Postprocessor
History and Summaries

Fig. A1 — CARMONETTE System Flow, GRC Version

In all function calls, variable names have the following meanings:

IDATA - location containing data to be modified, tested, etc.

NUM - a number specifying a contiguous number of bits (not to exceed 60)

NB - a bit number (1 to 60)

INSRT - word containing a bit string to be inserted into another word.

IONBIT. IONBIT will set to one bit number NB of IDATA. A copy of the modified IDATA is returned to I.

```
I = IONBIT (IDATA, NB)
```

IOFFBT. IOFFBT will set to zero bit number NB of IDATA. A copy of the modified IDATA is returned to I.

```
I = IOFFBT (IDATA, NB)
```

KBIT. KBIT will return the value true (a non- plus zero value) if bit number NB of IDATA is a 1, and will return the value false (plus zero) otherwise. KBIT must be declared logical.

```
IF (KBIT (IDATA, NB)) ...statement ....
```

```
IF (.NOT.KBIT (IDATA, NB)) will work only if the
   program was compiled by FORTRAN Extended.
```

NBITS. NBITS will return a count of the number of one bits in IDATA.

```
I = NBITS (IDATA)
```

KGET. KGET copies NUM bits of data starting at the NBth bit position of IDATA and returns the copied bits right justified to I. IDATA is not modified.

```
I = KGET (IDATA, NUM, NB)
```

KPUT. KPUT inserts the right most NUM bits of INSRT into a copy of IDATA beginning with bit number NB. IDATA is not modified.

```
I = KPUT (IDATA, NUM, NB, INSRT)
```

<u>IDATA</u>. To modify IDATA, code as:

```
IDATA = KPUT (IDATA, NUM, NB, INSRT)
```

No error checking is performed by any of the functions, hence the user is responsible for proper use. Results will be unpredictable if either NUM or NB contains a parameter that exceeds 60. Further, unless the user specifically desires wrap-around from the high to low order part of the word, NUM should not exceed 61-NB.

Appendix B

UNIVAC 1108 RUNNING GUIDE

INTRODUCTION

The GRC version of CARMONETTE was developed for the CDC 6400 computer. During the year 1974, the model was converted by US Army CAA to the UNIVAC 1108 computer. Significant modifications were made during the conversion to simplify running procedures on the UNIVAC 1108.

The CAA version of the model now exists as five basic programs: Terrain Generator, Preprocessor, Battle Model, Postprocessor, and the Range Postprocessor (See Fig. B1). Each program is independent and may be executed separately (in sequential order) or in one continuous runstream. The Terrain Generator and Preprocessor are used to edit and pack the input data. The Battle Model simulates the combat. The Postprocessor and Range Postprocessor prepare output reports.

Terrain Generator

Purpose. This program is used to create the land data file. The terrain inputs such as elevation, vegetation, roads, etc., are edited and packed for each grid square. If there are any detected errors they must be corrected and the program rerun before the land data file will be made. To create this file the program is run in the "TERGEN" mode. US Army CAA has developed an option to selectively change the terrain characteristics once the land data file is made. To update or alter these characteristics the program is run in the "UPDATE" mode.

Inputs.

(1) First Card - Run Parameters
Cols 1-6 "TERGEN" or "UPDATE"

(2) Terrain Data Forms. Ref: CARMONETTE, Vol 2.

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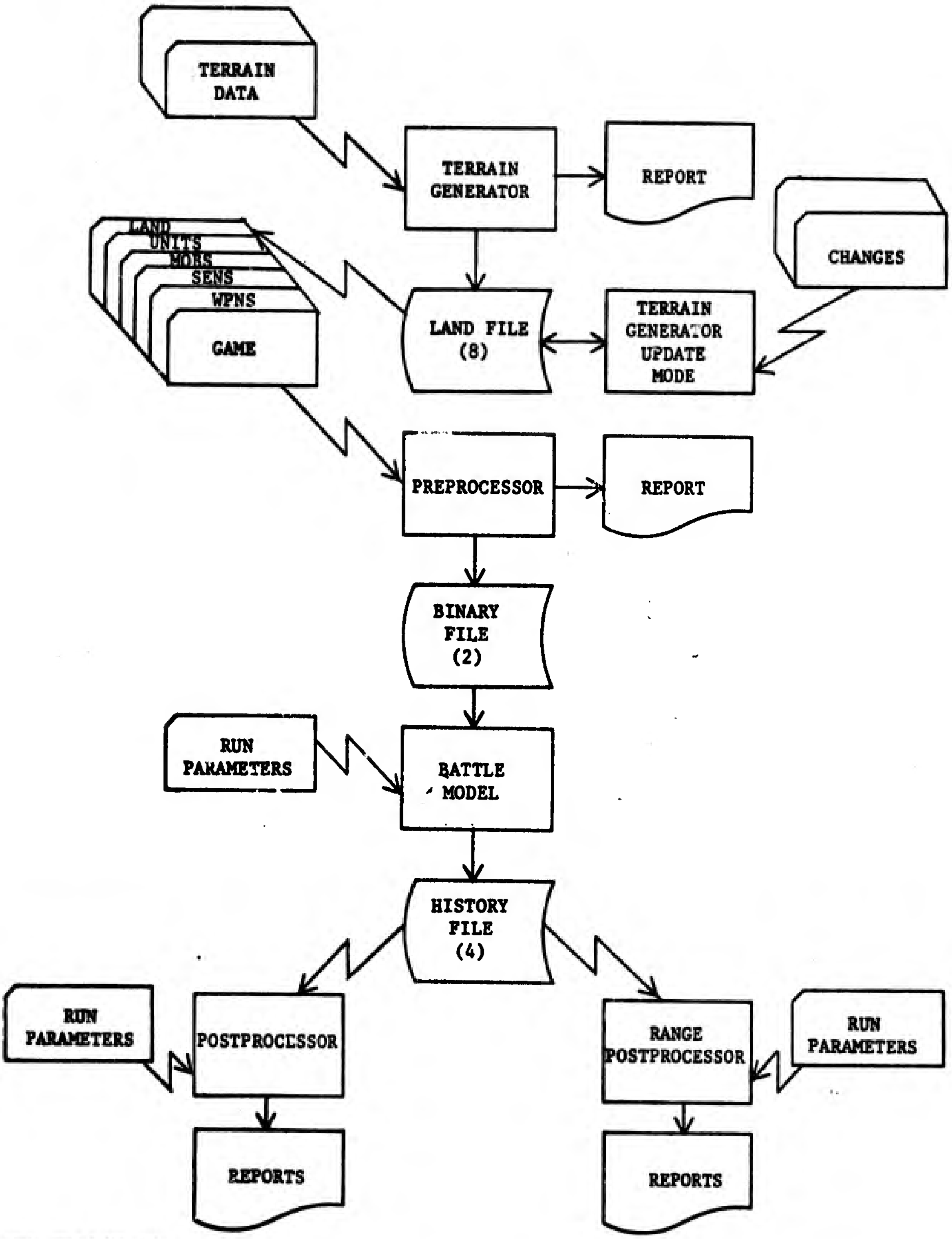
TERRAIN DATA
TERRAIN GENERATOR
REPORT
LAND
UNITS
MOBS
SENS
WPNS
GAME
LAND FILE (8)
CHANGES
TERRAIN GENERATOR UPDATE MODE
PREPROCESSOR
REPORT
BINARY FILE (2)
RUN PARAMETERS
BATTLE MODEL
HISTORY FILE (4)
RUN PARAMETERS
POSTPROCESSOR
RANGE POSTPROCESSOR
RUN PARAMETERS
REPORTS
REPORTS

Fig. B1 — CARMONETTE System Flow, CAA Version

(3) For an update run only: the Land Data File to be updated (including the LAND header card).

(4) Last Card-Sentinel.
Cols 73-76 "ENDN"

Outputs.

(1) Land Data File (file 8)

(2) Terrain Report

Preprocessor

Purpose. All of the required input data for the game, including the land data file, are processed by this program. The data is packed and stored on a binary file (file 2) for the Battle Model. A report is made of the input forms which are used and not used. Careful examination of this and the other reports should be made to insure the proper inputs before proceeding with the battle.

Inputs.

(1) First card-Run Parameters
Cols 1-4 Treatment Number for Identification
Cols 5-80 Identification label

(2) Game-Input Forms. Ref: CARMONETTE, Vol 2.

(3) Land Data File.

(4) Last Card-Sentinel
Cols 73-76 "ENDP"

Outputs.

(1) Binary Data File (file 2)

(2) Preprocessor Report

Battle Model

Purpose. This program performs the simulation of the combat events. The events which occur are based on a game clock. To terminate the clock it is necessary to set the maximum battle time entry on the run parameter card. Additional entries may be made to terminate the battle if a side acquires a certain amount of unit/vehicle casualties or if units reach a certain grid square. A random number seed is set within the program; however, a different seed may be input if desired. The ABUG dump times should only be used for program debugging problems.

Inputs.

(1) Binary Data File (file 2)

(2) Control Card-Run Parameters

Cols 1-4	Treatment number for identification
Cols 5-8	Number of replications per run
Cols 9-12	Max time limit for the battle (mins)
*Cols 13-16	Number of Red unit casualties to terminate battle
*Cols 17-20	Number of Blue unit casualties to terminate battle
*Cols 21-24	Number of Red vehicle casualties to terminate battle
*Cols 25-28	Number of Blue vehicle casualties to terminate battle
*Cols 29-32	x coordinate to terminate battle
*Cols 33-36	y coordinate to terminate battle
*Cols 37-40	Distance in meters to terminate battle
*Cols 41-44	Number of the side to terminate battle (1 = Blue, 2 = Red)
*Cols 45-48	Number of units to reach x, y to terminate battle
*Cols 49-55	ABUG Begin Time XX.XXX
*Cols 56-62	ABUG Ending Time XX.XXXX
*Cols 63-73	Random Number Seed (Max $2^{35}-1$)

---

*Optional inputs.

Outputs.

History Data File (file 4)

Postprocessor

Purpose. This program produces the output reports of the battle events. A control card is required for the run parameters of the type of reports to be made. The replication number entry is used to indicate the replication for which the complete event history is to be printed. If the number is 99 then all replications are printed. If "HISTRY" is an entry then the entire event history is reported. The "SELHIS" entry will print only the event of selected units. "SUMMRY" will print only the summary reports. The processing of the event history may be terminated by an entry for vehicle casualties. A time interval may be set to generate an ammo report by time periods.

Inputs.

(1) History Data File (file 4)
(2) Control Card-Run Parameters
    Cols 1-4 Treatment number
    Cols 5-8 Number of the replication to be printed
    Cols 10-15 "HISTRY" or "SELHIS" or "SUMMRY"
    Cols 16-19 Time interval for ammo report
    Cols 20-23 Number of Blue vehicle casualties to terminate report
    Cols 24-27 Number of Red vehicle casualties to terminate report
    * { Col 28 Number of the side for "SELHIS" report (1 = Blue, 2 = Red)
    Cols 29-30 Unit number for "SELHIS" report }
    : :
    : :
    *Cols 77-78 Unit numbers for "SELHIS" report.

---

*Three column field repeated for each unit desired.

Outputs.

Postprocessor reports

Range Postprocessor

Purpose. This program processes the History File and produces reports for each weapon fired. The reports give firing and kill information based on an input range interval.

Inputs.

(1) History Data File (file 4)

(2) Control Card-Run Parameters

Cols 2-5 Treatment number
Cols 6-10 Range interval (meters)

Outputs.

Range Report

Appendix C

UNIVAC 1108 DATA STORAGE

Because CARMONETTE was converted from the CDC 6400 (60-bit word) computer to the UNIVAC 1108 (36-bit word), allowances had to be made for the packing of data. In general two consecutive 36-bit words are used to store the data that was originally packed in one 60-bit word.

word 1	word 2
bits 0, 1, 2, . . . 35	0, 1, 2, . . . 35

The data is accessed by either of two means.

1. If the desired field is totally within a single word (either word 1 or word 2), the data is accessed by means of the FORTRAN V FLD functions.

2. If the desired field crosses word boundaries, the following utility routines are used. In all calls, variable names have the following meanings:

IDATA - location of the first word of the two-word array containing the data to be modified. The bits in the two words are numbered consecutively as in the following configuration:

word 1	word 2
0, 1, 2, . . . 35	36, 37, . . . 71

Assume the following values in the examples,

IDATA(1) = 111222333444_8

IDATA(2) = 555666777000_8

NUM - the length, in bits, of the field (not to exceed 36)
NB - a bit number (0-71)
INSRT - a data word. Assume a value of 777_8 in the examples.
IREC - a data word.

a. Subroutines

(1) Subroutine IONBIT (IDATA, NB)
IONBIT will set the NBth bit to one.

Example: CALL IONBIT (IDATA, 0) will reset IDATA(1) = 511222333444_8

(2) Subroutine IOFFBT (IDATA, NB)
IOFFBT will set the NBth bit to zero.

Example: CALL IOFFBT (IDATA, 46) will reset IDATA(2) = 555466777000_8

(3) Subroutine KPUT (IDATA, NUM, NB, INSRT)
KPUT will take the rightmost NUM bits of INSRT and insert them into IDATA starting at the NBth bit of IDATA.

Example: CALL KPUT (IDATA, 33, 9, INSRT) will reset IDATA(1) = 111222333447_8 and IDATA(2) = 775666777000_8

b. Functions

(1) Function KGET (IDATA, NUM, NB)
KGET will retrieve NUM bits from IDATA, starting with the NBth bit and places this information in the rightmost NUM bits of the calling program's receiving data word.

Example: IREC = KGET (IDATA, 6, 33) will set IREC = 45_8.

(2) Function KBIT (IDATA, NB)
KBIT is a logical function which returns a TRUE value of the NBth bit of IDATA is one and a FALSE value if the NBth bit is zero.

Example: IREC = KBIT (IDATA, 40) sets IREC = FALSE
IREC = KBIT (IDATA, 41) sets IREC = TRUE

(3) Function NBITS (IDATA)

NBITS returns a count of the number of one bits in the two-dimensional array IDATA.

Example: IREC = NBITS (IDATA) will set IREC = 36

Appendix D

DATA STORAGE FOR LABELED COMMON BLOCK MAIN

Contents	Variable	6400 words	1108 words	Page
Image Intensifier Devices, Background Reflectance	BREFM1	6,16	6,16	227
Visual Devices, Background Reflectance	BREFM3	16	16	227
Image Intensifier, Constant K1	CK1	6	6	227
Image Intensifier, Constant K2	CK2	6	6	227
Image Intensifier Devices, Modulation Transfer Function	EDMTF	6	6	227
Artillery Target Priority	IARTY	6,15,2	6,15,2	228
Helicopter Target Priority	IHELO	6,15,2	6,15,2	229
Air Mobility Data	JAMOB	5,3	2,5,3	230
Unit Attributes	JATRIB	48,2	2,48,2	232
Command, Control and Surveillance Unit Data	JCCS	6,15,2	2,6,15,2	234
Command, Control and Surveillance Unit Characteristics	JCMD	7,15,2	2,7,15,2	236
Unit Control Data	JCNTRL	11,48,2	2,11,48,2	238
Cover and Concealment Conversion Data	JCNVRT	6,10	2,6,10	242
Visibility Condition Data	JCOND	1	2	244
Special Data	JDATA	17	17	245
Minimum Target Dimension	JDIM	3	2,3	246
Image Intensifier Devices, Magnification	JDMAG	1	2	248
Target Detection Data	JDTECT	32,6,6	2,32,6,6	251
Probabilities of Kill, Frag Ammo	JFRAG	2,46	2,2,46	252
Game Control Data	JGAME	36	36	254
Ground Mobility Data	JGMOB	11,5	2,11,5	255
Unit Intelligence	JINTEL	8,48,2	2,8,48,2	257
Terrain Characteristics	JLAND	2112	63,64	259

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Contents	Variable	6400 words	1108 words	Page
Line of Sight Info	JLOS	48	2,48	261
Miscellaneous Data	JMISC	31	2,31	262
Mission Orders	JMISNS	999	999	267
Probabilities of Kill, Non-Frag Ammo	JPKILL	2,2,44	2,2,44	270
Radar Characteristics	JRADAR	6	2,6	273
Run Control Data	JRUN	14	14	274
Side Parameters	JSIDEP	110,2	2,110,2	275
Tactical Standard Deviations	JTACSD	12,44	2,12,44	279
Unit Characteristics	JUCHAR	10,48,2	2,10,48,2	281
Visual Devices Detection Data	JVISA	6,2	2,6,2	284
Weapons Basic Data	JWEAP	3,56	2,3,56	286
Not Used	NEXTRA	1	1	
Integral of Relative Luminosity Night Sky Brightness	P1	3	3	288
Image Intensifier Devices, Computed Integral Approximation	P2	6	6	288
Night Sky Brightness Wavelengths .4 to .9	SBK	11	11	288
Image Intensifier Devices, Target Reflectance	TREFM2	6,16	6,16	289
Visual Devices, Target Reflectance	TREFM4	16	16	289

Computational Values (Real)

Background reflectance of the grid square for I.I. devices BREFN1 (6,16). Sixteen words are used to store the background reflectance for I.I. devices for 16 background numbers of the grid squares for each of the 6 image intensifier devices. Each value for each device and each background number is stored as a real number.

Background reflectance of the grid square for visual devices BREFM3(16). Sixteen words are used to store the computed approximation of background reflectance of the grid square for visual devices for the 16 background numbers. Each value for each background number is stored as a real number.

Image intensifier constant K1 CK1 (6). Six words are used to store the computed value of $K1 = t \times Tau \times PI/4.$ DFNO for the 6 image intensifier devices. These are real numbers.

Image Intensifier constant K2 CK2 (6). Six words are used to store the computed value of $K2 = 4 \times PI\ (\text{resolution length})^2$ for the 6 image intensifier devices. Each value for each device is stored as a real number.

Modulation transfer function EDMTF (6). Six words are used to store the modulation transfer function for the 6 image intensifier devices. Each integral approximation for each device is stored as a real number.

Artillery Priority Target IARTY(6,15,2)

Form Unit 1.

Six words indicating target class priority per command unit capable of calling artillery support.

Helicopter Priority Target IHELO(6,15,2)

Form Unit 1.

Six words indicating target class priority per command unit capable of calling attack helicopter support.

Air Mobility Data JAM03 6400 (5,3) 1108 (2,5,3)

Forms Mobility 4, Mobility 5, Mobility 6.

Five words per air mobility class are required. One word contains five of the six altitude changes (in vertical feet per grid square) that an air mobility class can make. Word two contains the sixth altitude change, the attack speed index, and the first two of the five minimum moving times for an altitude change in a slope class. Word three contains the remaining three minimum moving times. Word four contains the standard altitude increment, the maximum altitude, the altitude above ground for contour flight, and the altitude for level flight. Word five contains the vertical descent time, the vertical climb time, and the dismount time.

Description		Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 1 Altitude change thresholds					
Steep descent threshold, ft/grid		LACTT(1)	60-49		13-24
Moderate descent threshold, ft/grid		LACTT(2)	48-37		1-12
Negligible descent threshold, ft/grid		LACTT(3)	36-25	25-35	0
Negligible climb threshold, ft/grid		LACTT(4)	24-13	13-24	
Moderate climb threshold, ft/grid		LACTT(5)	12-1	1-12	
Word 2 Miscellaneous overflow					
Steep climb threshold, ft/grid		LACTT(6)	60-49		13-24
Not used			48-41		5-12
Steep descent, ft/grid	3XX.XXXX	LMMTA(1)	40-21	21-35	0-4
Moderate descent, ft/grid	3XX.XXXX	LMMTA(2)	20-1	1-20	

6400 1108

Air Mobility Data JAMOB(5,3) (2,5,3) cont'd

Description		Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 3 Minimum moving times					
Negligible change	3XX.XXXX	LMMTA(3)	60-41		5-24
Moderate climb, ft/grid	3XX.XXXX	LMMTA(4)	40-21	21-35	0-4
Steep climb, ft/grid	3XX.XXXX	LMMTA(5)	20-1	1-20	
Word 4 Altitude and speed					
Standard altitude increment		LDELAS	60-46		10-24
Maximum altitude		KHI	45-31	31-35	0-9
Altitude above ground (contour)		LITA	30-16	16-30	
Altitude level flight		LARGA	15-1	1-15	
Word 5 Special times					
Vertical descent time	3XX.XXXX	INCTDN	60-40		4-24
Vertical climb time	3XX.XXXX	INCTUP	39-19	19-35	0-3
Dismount time	3XX.XXXX	KDMTIM	18-1	1-18	

	6400	1108
Unit Attributes	**JATRIB(48,2)**	**(2,48,2)**

Unit attributes are stored in one word per unit. A bit is ON if the unit has the attribute described.

Attribute	Local variable	6400 and 1108 Word 1 bit no.
Not used		1
Escape orders	LBUG	2
Call artillery	LKHQ	3
Infantry	INF	4
Troop carrier	.NOT. NTCU	5
Has restricted surveillance	LSURV	6
Aircraft	LLAC	7
Unable to fire	LFIRE	8
Unable to move	LMOB	9
Unit can provide air support	LASPT	10
Unit is dead	LSDEAD	11
Unit is dismounting	LFDISM	12
Unit is moving	LFMOVE	13
Unit can provide artillery support	LSPT	14
Unit is busy (responding to fire)	LFR	15
Not used		16
Unit may not fire until "white eye range"	LEYE	17
Unit is pinned down	LFR1	18
Unit is partially neutralized DF	LFR2	19
Unit is partially neutralized IF	LFR3	20
Unit is burning	LBURN	21
Unit has burned	LHBURN	22
Main weapon is aimed	KAIM	23
Main weapon has suppressive fire target	LTAREA	24
Main weapon is direct fire	KDF	25
Main weapon requires guidance	LGM	26
Weapon B is aimed	KAIM(2)	27

6400 1108
Unit Attributes JATRIB(48,2) (2,48,2) cont'd

Attribute	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Weapon B has suppressive fire target	LTAREA(2)	28	28	
Weapon B is direct fire	KDF(2)	29	29	
Weapon B requires guidance	LGM(2)	30	30	
Weapon C is aimed	KAIM(3)	31	31	
Weapon C has suppressive fire target	LTAREA(3)	32	32	
Weapon C is direct fire	KDF(3)	33	33	
Weapon C requires guidance	LGM(3)	34	34	
Weapon D is aimed	KAIM(4)	35	35	
Weapon D has suppressive fire target	LTAREA(4)	36		0
Weapon D is direct fire	KDF(4)	37		1
Weapon D requires guidance	LGM(4)	38		2
Unit is mounted	LIMBO	39		3
Unit is an artillery support unit (i.e., does not exist as a separate entity)	LART	40		4
Potential carrier	LPTC	41		5
Unit is on diagonal move	LDIAG	42		6
Present moving rate (m/sec) X.XXX	MVEL	60-43		7-24

Command, Control and Surveillance Unit Data JCCS(6,15,2) (2,6,15,2)

6400 1108

Form Unit 1 (Communications interval only).

Six words are used to store the information for the command units. The second word contains the unit control clock and the tactics clock. The third word contains the surveillance clocks for the two surveillance devices permitted each CCS unit. The fourth word contains the communications clock. The last two words contain the current order and the location for the unit.

Description		Local variable	6400 bit no.	1108 bit no.	
	Word 1 Not used				
	Word 2 Activities			Word 1	Word 2
Control time	XXX.XXXX	LCCLK	60-40		4-24
Control code		LCCDE	39-31	31-35	0-3
Not used			30-1	0-30	
	Word 3 Surveillance				
Surveillance device #1 time	XXX.XXXX	LSCLK	60-40		4-24
Surveillance code		LSCDE	39-31	31-35	0-3
Surveillance device #2 time	XXX.XXXX	LSCLK	30-10	10-30	
Surveillance code		LSCDE	9-1	1-9	

6400 1108
Command, Control and Surveillance Unit Data JCCS(6,15,2) (2,6,15,2) cont'd

Description	Local variable	6400 bit no.	1108 bit no.	
	Word 4 Communications		Word 1	Word 2
Communications time	LOCLK	60-40		4-24
Communications code	LOCDE	39-31	31-35	0-3
Communications interval	INTC	30-10	10-30	
Not used		9-2	2-9	
Unit is dead		1	1	
	Word 5 Current order			
(See description of JMISNS)				
Skip order time (not used in 6400)		60-49		13-24
Current order number		48-37		1-12
Current order (See description of JMISNS array for bit definition (page 267)		36-1	0-35	
	Word 6 Location and next order			
Current X coordinate	LXS	60-55		19-24
Original X coordinate	na	54-49		13-18
Current Y coordinate	IYS	48-43		7-12
Original Y coordinate	na	42-37		1-6
Current altitude	IZS	36-25	25-35	0
Next (or last) X coordinate	IXNEW	24-19	19-24	
Next (or last) Y coordinate	IYNEW	18-13	13-18	
Next order number	LTAGK	12-1	1-12	

Command Unit Characteristics 6400 JCMD(7,15,2) 1108 (2,7,15,2)

Description	Local variable	6400 bit no.	1108 bit no.	
Word 1 Characteristics			Word 1	Word 2
Superior HQ number	MBOSS	60-55		19-24
Number of subordinate HQ (1-6)	NSUB	54-49		13-18
Subordinate HQ #1	MYLT(1)	48-43		7-12
Subordinate HQ #2	MYLT(2)	42-37		1-6
Subordinate HQ #3	MYLT(3)	36-31	31-35	0
Subordinate HQ #4	MYLT(4)	30-25	25-30	
Subordinate HQ #5	MYLT(5)	24-19	19-24	
Subordinate HQ #6	MYLT(6)	18-13	13-18	
Subordinate unit #1	MYMEN(1)	12-7	7-12	
Subordinate unit #2	MYMEN(2)	6-1	1-6	
Word 2 Characteristics				
Number of weapon units assigned with	MBUDDY	60-55		19-24
Subordinate unit #3	MYMEN(3)	54-49		13-18
Subordinate unit #4	MYMEN(4)	48-43		7-12
Subordinate unit #5	MYMEN(5)	42-37		1-6
Not used		36-1	1-35	0
Word 3 Characterisitcs				
Subordinate unit #6	MYMEN(6)	60-55		19-24
Subordinate unit #7	MYMEN(7)	54-49		13-18
Subordinate unit #8	MYMEN(8)	48-43		7-12
Not used		42-41		5-6
Unit can call helicopter		40		4
Not used		38-39		2-3
Unit can call artillery	LKHQ	37		1
Not used		36-1	1-35	0

Command Unit Characteristics 6400 JCMD(7,15,2) 1108 (2,7,15,2) cont'd

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 4 Sensors				
Sensor #1 height	ISENH1	60-55		19-24
Sensor #1 class	ISENC1	54-42		16-18
Sensor #1 type	ISENT1	51-49		13-15
Sensor #2 height	ISENH2	48-43		7-12
Sensor #2 class	ISENC2	42-40		4-6
Sensor #2 type	ISENT2	39-37		1-3
Not used		36-1	1-35	0
Word 5 Characteristics				
Not used		60-49		13-24
Enemy units known dead	JCDEAD	48-1	1-35	0-12
Word 6 Characteristics				
Not used		60-49		13-24
Enemy units detected to nearest square	JCDET	48-1	1-35	0-12
Word 7 Characteristics				
Not used		60-49		13-24
Enemy weapon units in LOS	JCLOS	48-1	1-35	0-12

	6400	1108
Unit Control Data	JCNTRL(11,48,2)	(2,11,48,2)

Form Unit 10 (JCNTRL 10).

Unit control information is stored in 11 words. (If the next event is boundary crossing, the rest of the word contains the altitude increment and movement time from the boundary to the center of the next square.) Six words contain the unit's clocks; one word contains the number of rounds received; one word contains the current order; and one word contains the unit's location and a pointer to the next order. The last word contains the number of firings of the main weapon until the next order change and line of sight to enemy weapon units.

Description		Local variable	6400 bit no.	1108 bit no.	
		Word 1 Next event		Word 1	Word 2
Not used			60-51		15-24
Altitude change			50-36		0-14
Not used			35-31	31-35	
Time— boundary to center of square	XXX.XXXX	ITBC	30-10	10-30	
Not used			9-1	1-9	
		Word 2 Activities			
Control time	XXX.XXXX	LCCLK	60-40		4-24
Control code		LCCDE	39-31	31-35	0-3
Tactic time	XXX.XXXX	LTCLK	30-10	10-30	
Tactic code		LTCDE	9-1	1-9	
		Word 3 Surveillance devices			
Surveillance 1, time	XXX.XXXX	LSCLK(1)	60-40		4-24
Surveillance 1, code		LSCDE(1)	39-31	31-35	0-3
Surveillance 2, time	XXX.XXXX	LSCLK(2)	30-10	10-30	
Surveillance 2, code		LSCDE(2)	9-1	1-9	

6400 1108

Unit Control Data JCNTRL(11,48,2) (2,11,48,2) cont'd

Description		Local variable	6400 bit no.	1108 bit no.	
	Word 4 Main weapon			Word 1	Word 2
Event time	XXX.XXXX	LWCLK(1)	60-40		4-24
Event code		LWCDE(1)	39-31	31-35	0-3
Loading time	XXX.XXXX	LLCLK(1)	30-10	10-30	
Loading code		LLCDE(1)	9-1	1-9	
	Word 5 Weapon B				
See Word 4 for format		LWCLK(2)			
	Word 6 Weapon C				
See Word 4 for format		LWCLK(3)			
	Word 7 Weapon D				
See Word 4 for format		LWCLK(4)			
	Word 8 Fire received				
Direct fire received interval D-2		LLRD3	60-51		15-24
Direct fire received interval D-1		LLRD2	50-41		5-14
Direct fire received interval D		LLRD1	40-31	31-35	0-4
Indirect fire received interval D-2		LLRA3	30-21	21-30	
Indirect fire received interval D-1		LLRA2	20-11	11-20	
Indirect fire received interval D		LLRA1	10-1	1-10	

6400 1108
Unit Control Data JCNTRL(11,48,2)(2,11,48,2) cont'd

Word 9 Current order

(Contains a copy of JMISNS word. See JMISNS description)

	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Skip order time (Not used in 6400)	60-49		13-24
Current order number	48-37		1-12
Current order	36-1	0-35	

(see description of JMISNS array for bit definition (page 267)

Word 10 Location and next order

		6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Current X coordinate	IXS	60-55		19-24
Original X coordinate	na	54-49		13-18
Current Y coordinate	IYS	48-43		7-12
Original Y coordinate	na	42-37		1-6
Current altitude	IZS	36-25	25-35	0
Next (or last) X coordinate	IXNEW	24-19	19-24	
Next (or last) Y coordinate	IYNEW	18-13	13-18	
Next order number	LTAGK	12-1	1-12	

Word 11 Activities record

		6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Remaining firings until order change	LSMCHK	60-49		13-24
Line of sight to enemy weapon units		48-1	1-35	0-12

Unit Control Data JCNTRL$\overset{6400}{(11,48,2)}$ $\overset{1108}{(2,11,48,2)}$ cont'd

The following event codes are used in the control words:

Event	Decimal	Octal (9 bits)
Decision	0	000
Boundary crossing	8	010
End dismount	16	020
Surveillance	24 + MSENS*	03j (j=MSENS)
Change altitude	32	040
Communication	40	050
End mounting	48	060
Target selection	64 + MWP**	10i (i=MWP)
End aiming	72 + MWP	11i (i=MWP)
Impact	96 + MWP	14i (i=MWP)
Assessment	112 + MWP	16i (i=MWP)
End loading	192 + MWP	30i (i=MWP)
Tactics	320	500
Out of ammo	328	510

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*MSENS is assigned sensor group: Sensor A=1, Sensor B=2.

**MWP is assigned weapon group: Main=1, B=2, C=3, D=4.

6400 1108

Cover and Concealment Conversion JCNVRT(6,10) (2,6,10)

Form Terrain 2.

Six words per element size are required to convert the cover and concealment values of the terrain to element radii for hit probability and detection calculations.

Description	Local variable	6400 bit no.	1108 bit no.	
Word 1 Concealment conversion			Word 1	Word 2
Apparent radius (X.X) concealment Index 1	LCON1	60-55		19-24
Apparent radius (X.X) concealment Index 2	LCON1	54-49		13-18
Apparent radius (X.X) concealment Index 3	LCON1	48-43		7-12
Apparent radius (X.X) concealment Index 4	LCON1	42-37		1-6
Apparent radius (X.X) concealment Index 5	LCON1	36-31	31-35	0
Apparent radius (X.X) concealment Index 6	LCON1	30-25	25-30	
Apparent radius (X.X) concealment Index 7	LCON1	24-19	19-24	
Apparent radius (X.X) concealment Index 8	LCON1	18-13	13-18	
Not used		12-1	1-12	
Word 2 Concealment conversion				
Apparent radius (X.X) concealment Index 9	LCON1	60-55		19-24
Apparent radius (X.X) concealment Index 10	LCON1	54-49		13-18
Apparent radius (X.X) concealment Index 11	LCON1	48-43		7-12
Apparent radius (X.X) concealment Index 12	LCON1	42-37		1-6

6400 1108

Cover and Concealment Conversion JCNVRT(6,10) (2,6,10) cont'd

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 2 Concealment conversion				
Apparent radius (X.X) concealment Index 13	LCON1	36-31	31-35	0
Apparent radius (X.X) concealment Index 14	LCON1	30-25	25-30	
Apparent radius (X.X) concealment Index 15	LCON1	24-19	19-24	
Not used		18-1	1-18	
Word 3 Cover 1 conversion				
Apparent radius (X.X) cover Index 1	LCOV1	60-55		19-24
.	.	.		.
.	.	.		.
.	.	.		.
Word 4 Cover 1 conversion				
Apparent radius (X.X) cover Index 9	LCOV1	60-55		19-24
.	.	.		.
.	.	.		.
.	.	.		.
Word 5 Cover 2 conversion				
Net cover (1, 1, 3) cover Index 1	LCOV2	60-55		19-24
.	.	.		.
.	.	.		.
.	.	.		.
Word 6 Cover 2 conversion				
Net cover (1, 2, 3) cover Index 9	LCOV2	60-55		19-24
.	.	.		.
.	.	.		.
.	.	.		.

Conditions JCOND 1108 (2)

One word is used to store the visible light attenuation coefficients of scattering and absorption and the radar degradation factor.

Description		6400 bit no.	1108 bit no.	
			Word 1	Word 2
Scattering coefficient	X.XXXXXXX SIGS (times 10^7)	60-37		1-24
Absorption coefficient	XXX.XXXXX SIGA (times 10^5)	36-13	13-35	0
Radar degradation factor	X.XX	12-1	1-12	

Special Data JDATA(17)

This is a collection of data required to run the battle model more efficiently or to be used for debug runs on the battle model.

Description		Local variable	6400 and 1108 Word no.
Value of lower infinity*	377.7770_8	INFL	1
Value of upper infinity**	377.7777_8	INFU	2
Decision cycle		KCTIME	3
Assessment interval		KATIME	4
Neutralization interval		INTN	5
Not used		INTU	6
Neutralization clock		ICLKN	7
Not used		ICLKU	8
Control switch for using ABUG		NSWCH	9
Time to begin printing ABUG		NOW	10
Time to stop printing ABUG		LATER	11
Not used			12
Not used			13
Not used			14
Not used			15
Not used			16
Not used			17

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*INFL = 1048568_{10}

**INFU = 1048575_{10}

	6400	1108
Minimum Target Dimension	JDIM(3)	(2,3)

Three words are used to store the minimum target dimension for the 16 target classes.

Description		6400 bit no.	1108 bit no.	
	Word 1		Word 1	Word 2
Minimum target dimension Target Class 1	XX.X	60-52		16-24
Minimum target dimension Target Class 2	XX.X	51-43		7-15
Minimum target dimension Target Class 3	XX.X	42-34	34-35	0-6
Minimum target dimension Target Class 4	XX.X	33-25	25-33	
Minimum target dimension Target Class 5	XX.X	24-16	16-24	
Minimum target dimension Target Class 6	XX.X	15-7	7-15	
Not used		6-1	1-6	
	Word 2			
Minimum target dimension Target Class 7		60-52		16-24
Minimum target dimension Target Class 8		51-43		7-15
Minimum target dimension Target Class 9		42-34	34-35	0-6
Minimum target dimension Target Class 10		33-25	25-33	
Minimum target dimension Target Class 11		24-16	16-24	
Minimum target dimension Target Class 12		15-7	7-15	
Not used		6-1	1-6	

6400 1108
Minimum Target Dimension JDIM(3) (2,3) cont'd

Description	6400 bit no.	1108 bit no.	
	Word 3	Word 1	Word 2
Minimum target dimension Target Class 13	60-52		16-24
Minimum target dimension Target Class 14	51-43		7-15
Minimum target dimension Target Class 15	42-34	34-35	0-6
Minimum target dimension Target Class 16	33-25	25-33	
Not used	24-1	1-24	

Visual Device Magnification JDMAG 1108 (2)

One word is used to store the magnification of six visual devices and the light level condition.

Description		Local variable	6400 bit no.	1108 bit no.	
Magnification of Device 1	XX.X	DMAG(1)	60-52		16-24
Magnification of Device 2	XX.X	DMAG(2)	51-43		7-15
Magnification of Device 3	XX.X	DMAG(3)	42-34	34-35	0-6
Magnification of Device 4	XX.X	DMAG(4)	33-25	25-33	
Magnification of Device 5	XX.X	DMAG(5)	24-16	16-24	
Magnification of Device 6	XX.X	DMAG(6)	15-7	7-15	
Light level condition (1,2, or 3)		KOND	6-1	1-6	
1 = starlight					
2 = moonlight					
3 = part moon					

6400 1108
Target Detection Data JDTECT(32,6,6) (2,32,6,6)

Forms Sensor 1-10.

Thirty-two words are used to store the detection data for each sensor class and sensor type. The first word contains the scan time and probability of loss of nearest square information. The second word contains the solid angle thresholds (G1, G2, G3) for non-firing targets. Twenty-six words (3-28 incl.) contain the probability of detection of dead and non-firing targets. The format of these 26 words is uniform as follows ($\overline{P}$ observer not neutralized, $\overline{M}$ target not moving):

Odd numbered words ($\overline{M}$)	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
SA < G1, $\overline{P}$	60-55		19-24
G1 ≤ SA < G2, $\overline{P}$	54-49		13-18
G2 ≤ SA < G3, $\overline{P}$	48-43		7-12
G3 ≤ SA, $\overline{P}$	42-37		1-6
SA < G1, $\overline{P}$	36-31	31-35	0
G1 ≤ SA < G2, P	30-25	25-30	
G2 ≤ SA < G3, P	24-19	19-24	
G3 ≤ SA, P	18-13	13-18	
Not used	12-1	1-12	

Even numbered words (same except M, target moving)

Word 29 contains the solid angle thresholds for firing targets. Words 30 and 31 are the detection probabilities for firing targets. Word 32 contains the maximum solid angle thresholds for firing and non-firing targets. Word formats are as follows:

Word 1	Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Scan time	X.XXXX	ISCAN	60-46		10-24
Not used			45-7	7-35	0-9
Probability of loss of nearest square info target out of line-of-sight			6-1	1-6	

Target Detection Data $\overset{6400}{\text{JDTECT(32,6,6)}}$ $\overset{1108}{\text{(2,32,6,6)}}$ cont'd

Word 2 Solid Angle Thresholds Non-Firing Targets

Smallest solid angle G1	3XX.XXXX	LKGT1	60-41		5-24
Intermediate solid angle G2		LKGT2	40-21	21-35	0-4
Largest solid angle G3		LKGT3	20-1	1-20	

Words 3-28 Detection Probabilities

Word 3	Dead targets	LPDC
Word 4	Not used	
Words 5 & 6	IP12	LP12
Words 7 & 8	IP13	LP13
Words 9 & 10	IP14	LP14
Words 11 & 12	IP21	LP21
Words 13 & 14	IP23	LP23
Words 15 & 16	IP24	LP24
Words 17 & 18	IP31	LP31
Words 19 & 20	IP32	LP32
Words 21 & 22	IP34	LP34
Words 23 & 24	IP41	LP41
Words 25 & 26	IP42	LP42
Words 27 & 28	IP43	LP43

Word 29 Solid Angle Thresholds, Firing Targets

Smallest solid angle G1	3XX.XXXX	KSA1	60-41		5-24
Intermediate solid angle G2		KSA2	40-21	21-35	0-4
Largest solid angle G3		KSA3	20-1	1-20	

6400 1108
Target Detection Data JDTECT(32,6,6) (2,32,6,6) cont'd

Description	Local variable	6400 bit no	1108 bit no. Word 1	1108 bit no. Word 2
Word 30 Detection Probabilities, Firing Targets (No info to EPP)				
$SA < G1, P$	KDP13	60-55		19-24
$G1 \leq SA < G2, P$	KDP13	54-49		13-18
$G2 \leq SA < G3, P$	KDP13	48-43		7-12
$G3 \leq SA, P$	KDP13	42-37		1-6
$SA < G1, \overline{P}$	KDP13	26-31	31-35	0
$G1 \leq SA < G2, \overline{P}$	KDP13	30-25	25-30	
$G2 \leq SA < G3, \overline{P}$	KDP13	24-19	19-24	
$G3 \leq SA, \overline{P}$	KDP13	18-13	13-18	
Not used		12-1	1-12	
Word 31		(NS to PP)		
$SA < G1, P$	KDP34	60-55		19-24
$G1 \leq SA < G2$	KDP34	54-49		13-18
$G2 \leq SA < G3$	KDP34	48-43		7-12
$G3 \leq SA$	KDP34	42-37		1-6
$SA < G1, \overline{P}$	KDP34	36-31	31-35	0
$G1 \leq SA < G2$	KDP34	30-25	25-30	
$G2 \leq SA < G3$	KDP34	24-19	19-24	
$G3 \leq SA$	KDP34	18-13	13-18	
Not used	KDP34	12-1	1-12	
Word 32				
Not used		60-41		5-24
Max Solid angle threshold firing targets	MAXSRF	40-21	21-35	0-4
Max solid angle threshold non-firing targets	MAXSRG	20-1	1-20	

	6400	1108
Kill Probability Fragmentation Ammunition	JFRAG(2,46)	(2,2,46)

Forms Weapon 3, Weapon 4.

Two words per weapon are required to store the probability of kill (given a hit) of infantry by fragmentative weapons 1 through 34 and probability of kill on vehicles with troop survival for weapons 1 through 12.

Description	Local variable	6400 bit no.	1108 bit no.	
Word 1 Weapon 1			Word 1	Word 2
Kill probability, Ammo 1, Net Cover 1, Fire Response 1, 2, or 3	LPKIH	60-55		18-23
Kill probability, Ammo 1, Net Cover 2, Fire Response 1, 2, or 3	LPKIH	54-49		12-17
Kill probability, Ammo 1, Net Cover 3, Fire Response 1, 2, or 3	LPKIH	48-43		6-11
Kill probability, Ammo 1, Net Cover 1, Fire Response 4	LPKIH	42-37		0-5
Kill probability, Ammo 1, Net Cover 2, Fire Response 4	LPKIH	36-31	30-35	
Kill probability, Ammo 1, Net Cover 3, Fire Response 4	LPKIH	30-25	24-29	
Not used		24-1	0-23	
Word 2 Weapon 1				
Kill probability, Ammo 2, Net Cover 1, Fire Response 1, 2, or 3	LPKIH	60-55		18-23
Kill probability, Ammo 2, Net Cover 2, Fire Response 1, 2, or 3	LPKIH	54-49		12-17
Kill probability, Ammo 2, Net Cover 3 Fire Response 1, 2, or 3	LPKIH	48-43		6-11

Kill Probability Fragmentation Ammunition		6400 JFRAG(2,46)	1108 (2,2,46) cont'd	
			Word 1	Word 2
Word 2 Weapon 1 cont'd				
Kill Probability, Ammo 2, Net Cover 1 Fire Response 4	LPKIH	42-37		0-5
Kill Probability, Ammo 2, Net Cover 2 Fire Response 4	LPKIH	36-31	30-35	
Kill Probability, Ammo 2, Net Cover 3 Fire Response 4	LPKIH	30-25	24-29	
Not used		24-1	0-23	
⋮ ⋮				
Word 68 Weapon 34				
Kill Probability, Ammo 2, Net Cover 1	LPKIH	60-55		18-23
⋮ ⋮				
Kill Probability, Ammo Net Cover 3	LPKIH	30-25	24-29	
Not used		24-1	0-23	
Word 69 Weapon 1 cont'd				
Vehicles Kill Probability, Vul Class	1	60-49		12-23
AMMO 1	2	48-37		0-11
	3	36-25	24-35	
	4	24-13	12-23	
Troop Survival		12-7	6-11	
Not used		6-1	0-5	
Word 92 Weapon 12 cont'd				
AMMO 2				

Game Control Data JGAME(36)

Thirty-six words are used to control the game. Each is stored in a unique word for ease of control.

Description	Local variable	6400 and 1108 word no.
Current Treatment No.	NTR	1
Current Event Command Unit	IFHQ	2
Current Time XXX XXXX	KTIME	3
Current Event Side	MSIDE	4
Current Event Unit	MUNIT	5
Current Event Unit X Coordinate	IXS	6
Current Event Unit Y Coordinate	IYS	7
Current Event Unit Altitude	IZS	8
Current Event Code	KC0DE	9
Current Event Message Code	L0B	10
Current Weapon (Main, B, C, D)	MWP	11
Opposite Side (3-MSIDE)	I0PP	12
Current Random Number	NUMR	13
Meters per grid	MGRID	14
Number of Blue Weapon Units	JBLUE	15
Number of Red Weapon Units	JRED	16
Total Number of Enemy Weapon Units	ITNBR	17
Total Number of Blue Command Units	JCBLUE	18
Total Number of Red Command Units	JCRED	19
Total Number of Command Units	ICNBR	20
Current Number of Blue Casualties (men)	KASBLU	21
Current Number of Red Casualties (men)	KASRED	22
Current Event Sensor (A or B)	MSENS	23
Current Number of Blue Vehicle Casualties	KASBVH	24
Current Number of Red Vehicle Casualties	KASRVH	25
Not used		26-36

6400 1108
Ground Mobility Data JGMOB(11,5) (2,11,5)

Form Mobility 2.

Eleven words per ground mobility class are required. One word contains the dismount time (mount time in the case of infantry) and the slope thresholds. Ten words are required to give the minimum moving times for the slope classes and trafficability.

Description	Local variable	6400 bit no.	1108 bit no.	
Word 1 Time and slope thresholds			Word 1	Word 2
Dismount (mount) time	LDMTIM	60-41		5-24
Slope threshold M1	LSLOP(1)	40-31	31-35	0-4
Slope Threshold M2	LSLOP(2)	30-21	21-30	
Slope Threshold M3	LSLOP(3)	20-11	11-20	
Not used		10-1	1-10	
Word 2 Minimum moving times (H=1)				
Negligible slope, $\|\Delta E\| < M1$				
No road, T1	LMMTG	60-41		5-24
No road, T2	LMMTG	40-21	21-35	0-4
No road, T3	LMMTG	20-1	1-20	
Word 3 Minimum moving times (H=1)				
Negligible slope, $\|\Delta E\| < M1$				
Road, R1	LMMTG	60-41		5-24
Road, R2	LMMTG	40-21	21-35	0-4
Road, R3	LMMTG	20-1	1-20	
Word 4 Minimum moving times (H=2)				
Moderate downhill slope, $-M2 < \Delta E < -M1$				
No road, T1	LMMTG	60-41		5-24
No road, T2	LMMTG	40-21	21-35	0-4
No road, T3	LMMTG	20-1	1-20	

6400 1108
Ground Mobility Data JGMOB(11,5) (2,11,5) cont'd

Description	Local variable	6400 bit no.	1108 bit no.	
			Word 1	Word 2
Word 8 Minimum moving times (H=4)				
Moderate uphill slope, $M1 < \Delta E < M2$				
Road, R1	LMMTG	60-41		5-24
Road, R2	LMMTG	40-21	21-35	0-4
Road, R3	LMMTG	20-1	1-20	
Word 11 Minimum moving times (H=5)				
Steep uphill slope, $M2 < \Delta E < M3$				
Road, R1	LMMTG	60-41		5-24
Road, R2	LMMTG	40-21	21-35	0-4
Road, R3	LMMTG	20-1	1-20	

Unit Information JINTEL(8,48,2) (2,8,48,2)

	6400	1108
Unit Information	JINTEL(8,48,2)	(2,8,48,2)

Unit information concerning all enemy units is stored in eight words. Within each word, six enemy units are represented with ten items of information represented by the bits. A bit is on if the unit has the item of information concerning the enemy unit.

Information	Local variable	6400 bit no.
Enemy unit known dead	LDEAD	1
Enemy unit detected (nearest square)	M12	2
Enemy unit identified (erroneous pinpoint)	M13	3
Enemy unit recognized (accurately pinpointed).	M14	4
Enemy unit firing at other units interval D	LKEE1	5
Enemy unit firing at other units interval D-1	LKEE2	6
Enemy unit firing at other units interval D-2	LKEE3	7
Enemy unit firing at this unit interval D	LLEE1	8
Enemy unit firing at this unit interval D-1	LLEE2	9
Enemy unit firing at this unit interval D-2	LLEE3	10

Enemy unit numbers

6400 bits	60-51	50-41	40-31	30-21	20-11	10-1
Word 1	6	5	4	3	2	1
Word 2	12	11	10	9	8	7
Word 3	18	17	16	15	14	13
Word 4	24	23	22	21	20	19
Word 5	30	29	28	27	26	25
Word 6	36	35	34	33	32	31
Word 7	42	41	40	39	38	37
Word 8	48	47	46	45	44	43

6400 1108

Unit Information JINTEL(8,48,2) (2,8,48,2) cont'd

Enemy unit numbers

		Word 1			Word 2	
1108	1-10	11-20	21-30	31-35|0-4	5-14	15-24
Word 1	1	2	3	4	5	6
Word 2	7	8	9	10	11	12
Word 3	13	14	15	16	17	18
Word 4	19	20	21	22	23	24
Word 5	25	26	27	28	29	30
Word 6	31	32	33	34	35	36
Word 7	37	38	39	40	41	42
Word 8	43	44	45	46	47	48

NOTE (1108): When unpacking intelligence data for a unit the appropriate 10 bits are moved to bits 1-10 of a temporary word and then accessed as described under the local variable description on the previous page.

6400 1108

Terrain Characteristics JLAND(2112) (63,64)

Form Terrain 1 after being processed by the terrain generator.

For the CDC 6400 a 60 by 63 terrain grid is represented with two grids per 60 bit word in 2112 words. The storage space for the Y coordinates must be a multiple of two, thus Y goes to 64. Expansion of X to 63 is possible, and storage for X must be a multiple of 6, X goes to 66. 66 × 64/2 = 2112. X > 60 or Y > 63 is not currently processed.

Description	Local variable	6400 bit no.	I-Format
Word 1 Grid X1, Y1 and X2, Y1			
Grid X1, Y1			
Elevation (0-4095 ft)	LELEV	60-49	4
Vegetation (0-63 ft)	LVEG	48-43	2
Road trafficability (0,1,2,3)	LROAD	42-41	1
Cross-country trafficability (1,2,3)	LTRAF	40-39	1
Cover index (0-15)	LCOV	38-35	2
Concealment index (0-15)	LCON	34-31	2
Grid X2, Y1			
Elevation (0-4095 ft)	LELEV	30-19	4
Vegetation (0-63 ft)	LVEG	18-13	2
Road trafficability (0,1,2,3)	LROAD	12-11	1
Cross-country trafficability (1,2,3)	LTRAF	10-9	1
Cover index (0-15)	LCOV	8-5	2
Concealment index (0-15)	LCON	4-1	3

. .
. .
. .

Word 30 Grid X59, Y1 and X60, Y1

See Word 1 for format

. .
. .
. .

6400 1108

Terrain Characteristics JLAND(2112) (63,64) cont'd

For the UNIVAC 1108, the data is stored one square per word.

Word (X,Y)	LELEV	19-30
	LVEG	13-18
	LROAD	11-12
	LTRAF	9-10
	LCOV	5-8
	LCON	1-4

	6400	1108
Line of Sight Information	JLOS(48)	(2,48)

6400

The line-of-sight information is contained in 48 words. The word number in the array corresponds to the Blue unit number. The bit number in each word corresponds to the Red unit number. A bit is on if the pair is intervisible. Bits 49-60 in each word are not used.

1108
bit no.

		Word 1	Word 2
Not used			13-35
Red units	36-48		0-12
Red units	1-35	1-35	

	6400	1108
Miscellaneous Data	JMISC(31)	(2,31)

Forms Mobility 6, Unit 4, Unit 8.

The following miscellaneous data are stored as follows:

Description		Local variable	6400 bit no.	1108 bit no.	
	Word 1 Ordered moving time ground			Word 1	Word 2
Ordered moving time, Rate 0	3XX.XXXX	LOMTG(1)	60-41		5-24
Ordered moving time, Rate 1	3XX.XXXX	LOMTG(2)	40-21	21-35	0-4
Ordered moving time, Rate 2	3XX.XXXX	LOMTG(3)	20-1	1-20	
	Word 2 Ordered moving time ground				
Ordered moving time, Rate 3	3XX.XXXX	LOMTG(4)	60-41		5-24
Ordered moving time, Rate 4	3XX.XXXX	LOMTG(5)	40-21	21-35	0-4
Ordered moving time, Rate 5	3XX.XXXX	LOMTG(6)	20-1	1-20	
	Word 3 Ordered moving time ground				
Ordered moving time, Rate 6	3XX.XXXX	LOMTG(7)	60-41		5-24
Not used			40-1	1-35	0-4
	Word 4 Ordered moving time air				
Ordered moving time, Rate 0		LOMTA(1)	60-41		5-24
Ordered moving time, Rate 1		LOMTA(2)	40-21	21-35	0-4
Ordered moving time, Rate 2		LOMTA(3)	20-1	1-20	

6400 1108
Miscellaneous Data JMISC(31) (2,31) cont'd

Description	Local variable	6400 bit no.	1108 bit no.	
			Word 1	Word 2
Word 5 Ordered moving time air				
Ordered moving time, Rate 3	LOMTA(4)	60-41		5-24
Ordered moving time, Rate 4	LOMTA(5)	40-21	21-35	0-4
Ordered moving time, Rate 5	LOMTA(6)	20-1	1-20	
Word 6 Ordered moving time air				
Ordered moving time, Rate 6	LOMTA(7)	60-41		5-24
Not used		40-1	1-35	0-4
Word 7 Vulnerability range thresholds				
Near range threshold	KSVRN	60-49		13-24
Far range threshold	KSVRF	48-31	31-35	0-12
Not used		30-1	1-30	
Word 8 Vulnerability Class 1, Seriously vulnerable				
Target Class 1, d ≤ R1	MCVTS(1,1)	1	1	
Target Class 2, d ≤ R1	MCVTS(2,1)	2	2	
Target Class 3, d ≤ R1	MCVTS(3,1)	3	3	
Target Class 4, d ≤ R1	MCVTS(4,1)	4	4	
Target Class 5, d ≤ R1	MCVTS(5,1)	5	5	
Target Class 6, d ≤ R1	MCVTS(6,1)	6	6	
Target Class 7, d ≤ R1	MCVTS(7,1)	7	7	
Target Class 8, d ≤ R1	MCVTS(8,1)	8	8	
Target Class 9, d ≤ R1	MCVTS(9,1)	9	9	
Target Class 10, d ≤ R1	MCVTS(10,1)	10	10	
Target Class 11, d ≤ R1	MCVTS(11,1)	11	11	
Target Class 12, d ≤ R1	MCVTS(12,1)	12	12	
Target Class 13, d ≤ R1	MCVTS(13,1)	13	13	

6400 1108
Miscellaneous Data JMISC(31) (2,31) cont'd

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 8 Vulnerability Class 1, Seriously vulnerable				
Target Class 14, $d < R1$	MCVTS(14,1)	14	14	
Target Class 15, $d < R1$	MCVTS(15,1)	15	15	
Target Class 16, $d < R1$	MCVTS(16,1)	16	16	
Target Class 1, $R1 < d \leq R2$	MCVTS(1,2)	17	17	
Target Class 2, $R1 < d \leq R2$	MCVTS(2,2)	18	18	
Target Class 3, $R1 < d \leq R2$	MCVTS(3,2)	19	19	
Target Class 4, $R1 < d \leq R2$	MCVTS(4,2)	20	20	
Target Class 5, $R1 < d \leq R2$	MCVTS(5,2)	21	21	
Target Class 6, $R1 < d \leq R2$	MCVTS(6,2)	22	22	
Target Class 7, $R1 < d \leq R2$	MCVTS(7,2)	23	23	
Target Class 8, $R1 < d \leq R2$	MCVTS(8,2)	24	24	
Target Class 9, $R1 < d \leq R2$	MCVTS(9,2)	25	25	
Target Class 10, $R1 < d \leq R2$	MCVTS(10,2)	26	26	
Target Class 11, $R1 < d \leq R2$	MCVTS(11,2)	27	27	
Target Class 12, $R1 < d \leq R2$	MCVTS(12,2)	28	28	
Target Class 13, $R1 < d \leq R2$	MCVTS(13,2)	29	29	
Target Class 14, $R1 < d \leq R2$	MCVTS(14,2)	30	30	
Target Class 15, $R1 < d \leq R2$	MCVTS(15,2)	31	31	
Target Class 16, $R1 < d \leq R2$	MCVTS(16,2)	32	32	
Target Class 1, $d > R2$	MCVTS(1,3)	33	33	
Target Class 2, $d > R2$	MCVTS(2,3)	34	34	
Target Class 3, $d > R2$	MCVTS(3,3)	35	35	
Target Class 4, $d > R2$	MCVTS(4,3)	36		0
Target Class 5, $d > R2$	MCVTS(5,3)	37		1
Target Class 6, $d > R2$	MCVTS(6,3)	38		2
Target Class 7, $d > R2$	MCVTS(7,3)	39		3
Target Class 8, $d > R2$	MCVTS(8,3)	40		4

6400 1108
Miscellaneous Data JMISC(31) (2,31) cont'd

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 8 Vulnerability Class 1, Seriously vulnerable				
Target Class 9, d > R2	MCVTS(9,3)	41		5
Target Class 10, d > R2	MCVTS(10,3)	42		6
Target Class 11, d > R2	MCVTS(11,3)	43		7
Target Class 12, d > R2	MCVTS(12,3)	44		8
Target Class 13, d > R2	MCVTS(13,3)	45		9
Target Class 14, d > R2	MCVTS(14,3)	46		10
Target Class 15, d > R2	MCVTS(15,3)	47		11
Target Class 16, d > R2	MCVTS(16,3)	48		12
Probability of indicating death when killed	KBURN	60-55		19-24

Word 9 Vulnerability Class 2, Seriously vulnerable

See Word 8 for format

. .
. .
. .

Word 19 Vulnerability Class 12, Seriously vulnerable

See Word 8 for format

. .
. .
. .

Word 20 Vulnerability Class 1, Moderately vulnerable

See Word 8 for format
(does not include KBURN)

MCTM(1,1)

. . .
. . .

6400 1108
Miscellaneous Data JMISC(31) (2,31) cont'd

Word 31 Vulnerability Class 12, Moderately vulnerable

See Word 8 for format
(does not include KBURN)

.
.
.

MCVTM(16,3)

Scenarios JMISNS(999)

Form Unit 8.

A series of orders for each unit simulated is defined as the game scenario. Each unit has its next sequential order number stored in Word 10 of Unit Control Data (JCNTRL). Each order defines its subsequent order either explicitly or conditionally. Any combination of units on either side may utilize the same sequence of orders. No provision exists for permitting a unit to follow a sequence and then diverge to follow a different sequence. (All units given the same initial order number must follow that same sequence.) (Input format limits the total number of orders to 999.) The following is a description of the storage of order data for the CDC 6400. See Figure D1 for UNIVAC 1108 data storage.

NSTP

36 - 34	MWG = 4
33 - 31	altitude
27 - 25	rate
18 - 13	X (obj)
12 - 7	Y (obj)
6 - 4	kind of fire
3 - 1	priority of fire

MOVE

36 - 34	MWG = 6
30 - 28	doctrine
27 - 25	rate
18 - 13	X (obj)
12 - 7	Y (obj)
6 - 4	kind of fire
3 - 1	priority of fire

STAY

INTL

36 - 34	MWG = 1
24 - 22	MWR = 2
21 - 19	MWB = # volleys to fire
18 - 7	NWTIME = time
6 - 4	kind of fire
3 - 1	priority of fire

FIRE

36 - 34	MWG = 1
24 - 22	MWR = 4
21 - 19	MWB = # volleys to fire
18 - 13	X (target)
12 - 7	Y (target)
6 - 4	kind of fire
3 - 1	priority of fire

TIME

36 - 34	MWG = 1
24 - 22	MWR = 3
21 - 19	MWB = # volleys to fire
18 - 7	MWTIME = time
6 - 4	kind of fire
3 - 1	priority of fire

If unit has a target with INTL or TIME the target coordinates will be stored in the targets JCNTRL array.

Scenarios JMISNS(999) cont'd

DISM

36 - 34 MWG = 2

CHAL

36 - 34 MWG = 3

LOS

33-31 MWI = 2

TRTP

33-31 MWI = 1

LAND

33-31 MWI = 0

REMO

36 - 34 MWG = 5

SKIP

36-34 MWG = 0
33-29 P value
28 Forw = 0, Back = 1 (LPSKIP)
27-22 Number of orders to skip

ENCA

P value = 7
21-10 = # Cas

FRCA

Vul. Class

P value = 9
21-16 # Cas
6-1 Vul Class

Personnel

P value = 6
21-10 # Cas

ENUN

RNGE

P value = 8
21-16 # Units
15-1 Range squared

DEAD

P value = 3
21-16 # Units

FRUN

P value = 2
21-16 # Units

TIME

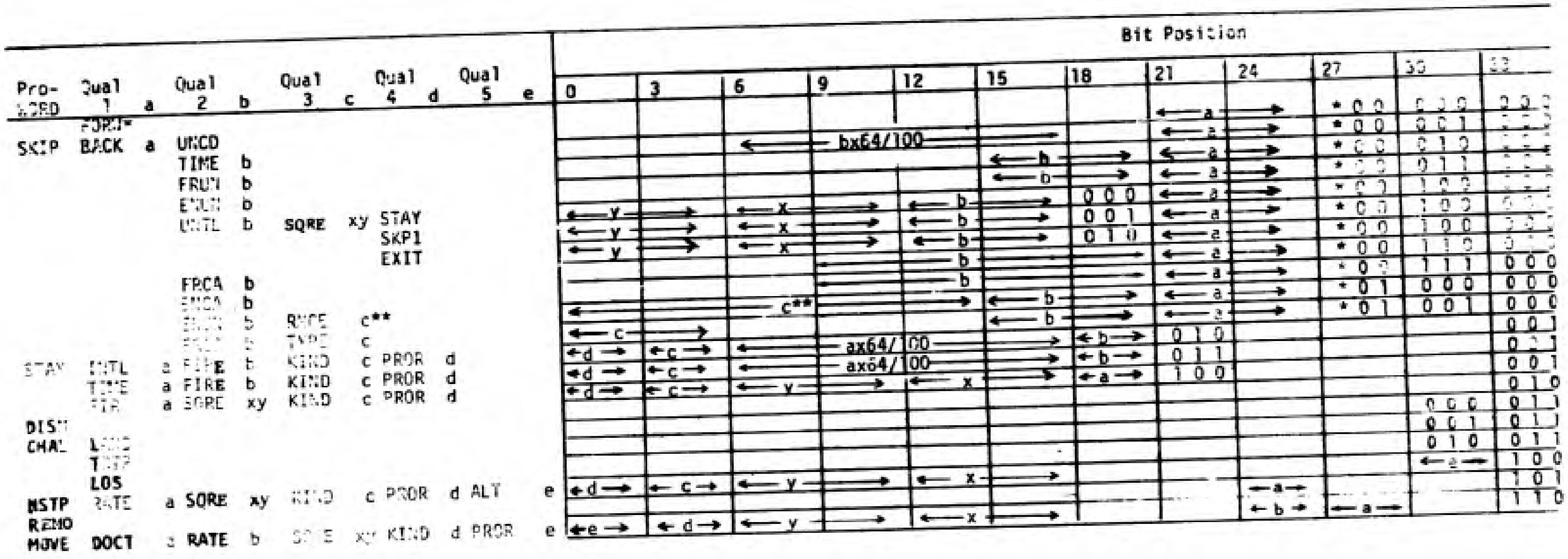
P value = 1
18-7 Time

UNCD

P value = 0

UNTL

P value = 4
20-19 0-stay, 1-skip1, 2-exit
18-13 Unit No.
12-7 X
6-1 Y


Pro-WORD
Qual 1
a
Qual 2
b
Qual 3
c
Qual 4
d
Qual 5
e
Bit Position
0
3
6
9
12
15
18
21
24
27
30
33
SKIP
FORW*
BACK
UNCD
TIME
FRUN
ENUN
UNTL
SQRE
xy
STAY
SKP1
EXIT
FRCA
ENCA
RNGE
TYPE
c**
STAY
INTL
TIME
FIR
FIRE
KIND
PROR
DIST
CHAL
LOS
MSTP
RATE
SQRE
ALT
REMO
MOVE
DOCT
RATE
KIND
bx64/100
ax64/100
a
b
c
d
e
x
y
* 0 0
* 0 1
000
001
010
011
100
101
110
111

FORW = 0 in bit 27
BACK = 1 in bit 27

** Stored value is range 2

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Fig. D1 - UNIVAC 1108 Storage of JMISN Data

Kill Probability Non-Fragmentation Ammunition JPKILL(2,2,44)

Form Weapon 3.

Four words are required to store the kill probabilities of each vulnerability class to each ammo type.

Description	Local variable	6400 bit no.	1108 bit no.
Word 1 Weapon #13			
Kill probability vulnerability Class 1, Ammo 1	LPKH	60-55	30-35
Kill probability vulnerability Class 2, Ammo 1	LPKH	54-49	24-29
Kill probability vulnerability Class 3, Ammo 1	LPKH	48-43	18-23
Kill probability vulnerability Class 4, Ammo 1	LPKH	42-37	12-17
Kill probability vulnerability Class 5, Ammo 1	LPKH	36-31	6-11
Kill probability vulnerability Class 6, Ammo 1	LPKH	30-25	0-5
Word 2 Weapon #13			
Kill probability vulnerability Class 7, Ammo 1	LPKH	60-55	30-35
Kill probability vulnerability Class 8, Ammo 1	LPKH	54-49	24-29
Kill probability vulnerability Class 9, Ammo 1	LPKH	48-43	18-23
Kill probability vulnerability Class 10, Ammo 1	LPKH	42-37	12-17
Kill probability vulnerability Class 11, Ammo 1	LPKH	36-31	6-11
Kill probability vulnerability Class 12, Ammo 1	LPKH	30-25	0-5

Kill Probability Non-Fragmentation Ammunition JPKILL(2,2,44) cont'd

Description	Local variable	6400 bit no.	1108 bit no.
Word 3 Weapon #13			
Kill probability vulnerability Class 1, Ammo 2	LPKH	60-55	30-35
Kill probability vulnerability Class 2, Ammo 2	LPKH	54-49	24-29
Kill probability vulnerability Class 3, Ammo 2	LPKH	48-43	18-23
Kill probability vulnerability Class 4, Ammo 2	LPKH	42-37	12-17
Kill probability vulnerability Class 5, Ammo 2	LPKH	36-31	6-11
Kill probability vulnerability Class 6, Ammo 2	LPKH	30-25	0-5
Not used		24-1	
Word 4 Weapon #13			
Kill probability vulnerability Class 7, Ammo 2	LPKH	60-55	30-35
Kill probability vulnerability Class 8, Ammo 2	LPKH	54-49	24-29
Kill probability vulnerability Class 9, Ammo 2	LPKH	48-43	18-23
Kill probability vulnerability Class 10, Ammo 2	LPKH	42-37	12-17
Kill probability vulnerability Class 11, Ammo 2	LPKH	36-31	6-11
Kill probability vulnerability Class 12, Ammo 2	LPKH	30-25	0-5
Not used		24-1	

Kill Probability Non-Fragmentation Ammunition JPKILL(2,2,44) cont'd

Description	Local variable	6400 bit no.	1108 bit no.
Word 176 Weapon #56			
Kill probability vulnerability Class 7, Ammo 2	LPKH	60-55	30-35
. . .	. . .	. . .	. . .
Kill probability vulnerability Class 12, Ammo 2	LPKH	30-25	0-5

	6400	1108
Radar Characteristics	JRADAR(6)	(2,6)

One word is used to store the radar characteristics for each of six radars.

Description	Local variable	6400 bit no.	1108 bit no.	
			Word 1	Word 2
Maximum range personnel	MRPER	60-46		10-24
Maximum range vehicles	MRVEH	45-28	28-35	0-9
Threshold velocity of target	MRVEL	27-13	13-27	
Not used		12-1	1-12	

Run Control Data JRUN(14)

Fourteen words contain the run control data.

Description	Local variable	6400 and 1108 word no.
Maximum battle time	KMAX	1
Maximum number of replications	NR	2
Initial random number	KN	3
Treatment data to be used	NT	4
X coordinate for proximity termination	KX	5
Y coordinate for proximity termination	KY	6
Distance for proximity termination	KDIS	7
Side for proximity termination	KSIDE	8
Number of units for proximity termination	KUNITS	9
Red fraction of casualties for termination	KREDFC	10
Blue fraction of casualties for termination	KBLUFC	11
Not used		12
Last random number	KSTRN	13
Current replication number	NRP	14

	6400	1108
Side Parameters	JSIDEP(110,2)	(2,110,2)

Forms Unit 5 (1-4), Unit 2(5), Unit 7(6), Mobility 1(7-22), Weapon 5(5,23-110).

The side parameters consist of 110 words. The first four words contain the side's thresholds for response to enemy fire. The next word contains the "white eye" range and suppressive fire area for the side. The next word contains the exit points. The next 16 words contain the moving probabilities for each mobility class and movement doctrine. Eight words describe the priority of targets for weapons assigned to the side.

Description	Local variable	6400 bit no.	1108 bit no.	
Word 1 Infantry thresholds			Word 1	Word 2
Infantry pinned down, DF + IF	LLTF1	60-48		12-24
Infantry partially neut., DF	LLTF2	47-36		0-11
Infantry partially neut., IF	LLTF3	35-24	24-35	
Not used		23-1	1-23	
Word 2 Aircraft thresholds				
Aircraft abort firing run	LLTHF	60-49		13-24
Aircraft drop to treetop altitude	LLTHN	48-37		1-12
Not used		36-1	1-35	0
Word 3 Armored thresholds				
Light armored vehicles DF	LLTM2	60-49		13-24
Light armored vehilces IF	LLTM2	48-37		1-12
Heavy armored vehicles DF	LLTM3	36-25	25-35	0
Heavy armored vehicles IF	LLTM3	24-13	13-24	
Not used		12-1	1-12	

6400 1108

Side Parameters JSIDEP(110,2) (2,110,2) cont'd

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 4 Open vehicle thresholds				
Open vehicle pinned down	LLTZ1	60-48		12-34
Open vehicle partially neut., DF	LLTZ2	47-36		0-11
Open vehicle partially neut., IF	LLTZ3	35-24	24-35	
Not used		23-1	1-23	
Word 5 White eye range & suppression area				
White eye range	KWER	60-47		11-24
Suppressive fire search radius	LASQ	46-35	35	0-10
Not used		34-1	1-34	
Word 6 Escape points				
X Coord of 1st escape point	LEXITX(1)	60-55		19-24
Y Coord of 1st escape point	LEXITY(1)	54-49		13-18
X Coord of 2nd escape point	LEXITX(2)	48-43		7-12
Y Coord of 2nd escape point	LEXITY(2)	42-37		1-6
X Coord of 3rd escape point	LEXITX(3)	36-31	31-35	0
Y Coord of 3rd escape point	LEXITY(3)	30-25	25-30	
Not used		24-1	1-24	
Word 7 Moving probabilities				
Mobility Class 0, Moving Doctrine 1				
Target no, cover no	LMVPRB(1)	60-55		19-24
Target yes, cover no	LMVPRB(2)	54-49		13-18
Target no, cover yes	LMVPRB(3)	48-43		7-12
Target yes, cover yes	LMVPRB(4)	42-37		1-6

6400 1108

Side Parameters JSIDEP(110,2) (2,110,2) cont'd

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 7 Moving probabilities			Word 1	Word 2
Mobility Class 1, Moving Doctrine 2				
Target no, cover no	LMVPRB(1)	36-31	31-35	0
Target yes, cover no	LMVPRB(2)	30-25	25-30	
Target no, cover yes	LMVPRB(3)	24-19	19-24	
Target yes, cover yes	LMVPRB(4)	18-13	13-18	
Not used		12-1	1-12	

Word 8 Moving probabilities

Mobility Class 0, Moving Doctrines 3 and 4

See Word 7 for format

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. .

Word 22 Moving probabilities

Mobility Class 7, Moving Doctrines 3 and 4

See Word 7 for format

Word 23 and 24, Weapon 13 Priority Lists

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Target class 1st priority, 1st sought	NCT(1)	60-56		20-24
Target class 1st priority, 2nd sought	NCT(2)	55-51		15-19
Target class 1st priority, 3rd sought	NCT(3)	50-46		10-14
Target class 1st priority, 4th sought	NCT(4)	45-41		5-9
Target class 1st priority, 5th sought	NCT(5)	40-36		0-4
Target class 1st priority, 6th sought	NCT(6)	35-31	31-35	

6400 1108
Side Parameters JSIDEP(110,2) (2,110,2) cont'd

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Words 23 and 24, Weapon 13 Priority Lists cont'd				
Target Class 2nd priority, 1st sought	NCT(1)	30-26	26-30	
Target Class 2nd priority, 2nd sought	NCT(2)	25-21	21-25	
Target Class 2nd priority, 3rd sought	NCT(3)	20-16	16-20	
Target Class 2nd priority, 4th sought	NCT(4)	15-11	11-15	
Target Class 2nd priority, 5th sought	NCT(5)	10-6	6-10	
Target Class 2nd priority, 6th sought	NCT(6)	5-1	1-5	
Target Class 3rd priority, 1st sought	NCT(1)	60-56		20-24
Target Class 3rd priority, 2nd sought	NCT(2)	55-51		15-19
Target Class 3rd priority, 3rd sought	NCT(3)	50-46		10-14
Target Class 3rd priority, 4th sought	NCT(4)	45-41		5-9
Target Class 3rd priority 5th sought	NCT(5)	40-36		0-4
Target Class 3rd priority 6th sought	NCT(6)	35-31	31-35	
Not used		30-1	1-30	

Words 25 and 26, Weapon 14 priority lists

See Words 23 and 24 for format

Words 109 and 110, Weapon 56 priority lists

See Words 23 and 24 for format

		6400	1108
Total Tactical Standard Deviation		JTACSD(12,44)	(2,12,44)

Form Weapon 2.

Twelve words per direct fire weapon type are required to store the parameters for the hit probability estimator. The Tactical Standard Deviation Parameters are stored for (1) zero, .707 max, and max range, (2) firer moving or not moving, (3) target moving or not moving, (4) ammo type 1 or 2, (5) firer neutralized or not neutralized, (6) first round, not first round with previous round hit, a not first round with previous round miss.

The forty-four weapon types are 13-56 inclusive.

The bit pattern and local variables in each word are standard as follows:

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Zero range, Ammo #1	SIGA	60-51		15-24
.707 max range, Ammo #1	SIGB	50-41		5-14
Max range, Ammo #1	SIGC	40-31	31-35	0-4
Zero range, Ammo #2	SIGA	30-21	21-30	
.707 max range, Ammo #2	SIGB	20-11	11-20	
Max range, Ammo #2	SIGC	10-1	1-10	

Words 1 thru 8 contain data for first round, 9-12 for subsequent rounds as follows ($\overline{P}$ firer not moving, $\overline{M}$ target not moving):

Word No. 1

P, $\overline{M}$, firer not neutralized

Word No. 2

P, $\overline{M}$, firer neutralized

Word No. 3

P, M, firer not neutralized

Word No. 4

P, M, firer neutralized

Total Tactical Standard Deviation JTACSD$\overset{6400}{(12,44)}$ $\overset{1108}{(2,12,44)}$ cont'd

Word No. 5

$\overline{P}$, $\overline{M}$, firer not neutralized

Word No. 6

$\overline{P}$, $\overline{M}$, firer neutralized

Word No. 7

$\overline{P}$, M, firer not neutralized

Word No. 8

$\overline{P}$, M, firer neutralized

Word No. 9

$\overline{P}$, $\overline{M}$, firer not neutralized, previous round hit

Word No. 10

$\overline{P}$, $\overline{M}$, firer neutralized, previous round hit

Word No. 11

$\overline{P}$, $\overline{M}$, firer not neutralized, previous round miss

Word No. 12

$\overline{P}$, $\overline{M}$, firer neutralized, previous round miss

6400 1108

Unit Characteristics JUCHAR(10,48,2) (2,10,48,2)

Forms Unit 2, Unit 3.

Ten words are used to describe the unit characteristics. Two words contain unit classification data and eight words contain weapons data.

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 1 Unit descriptors				
Original number of men	LMAN	60-55		18-23
Current number of men	KMAN	54-49		12-17
Original number of vehicles	LVEH	48-43		6-11
Current number of vehicles	KVEH	42-37		0-5
Number of drivers	KMI	36-31	30-35	
Max number of men/vehicles	MMPV	30-25	24-29	
Unit sensor height	LTALL	24-19	18-23	
Unit deployment radius	IRADU	18-13	12-17	
Apparent radius for detection	LCON1	12-7	6-11	
Apparent radius for hit	LCOV1	6-1	0-5	
Word 2 Unit descriptors				
Target class	LCT	60-55		18-23
Vulnerability class	LCV	54-49		12-17
Element size class	IRAD	48-43		6-11
Mobility class	LCM	42-37		0-5
Fire response class	IFRT	36-31	30-35	
Sensor #1 class	LSC	30-28	27-29	
Sensor #1 type	LST	27-25	24-26	
Net cover index	LCOV2	24-19	18-23	
Second storage place for target no. in call helo		18-13	12-17	
Superior unit number	MBOSS	12-7	6-11	
Fraction of time unavailable to provide support fire	LFTU	6-1	0-5	

6400 1108
Unit Characteristics JUCHAR(10,48,2) (2,10,48,2) cont'd

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 3 Main weapon description				
Weapon type	MWPT	60-55		18-23
Number of weapons	KTUBE	54-49		12-17
Target number	ITNO	48-43		6-11
Target X coordinate	IXT	42-37		0-5
Target Y coordinate	IYT	36-31	30-35	
Pinpoint and neutralization status	ITP	30-25	24-29	
Ammo type	IA	24-19	18-23	
Hit signal	JHIT	18-13	12-17	
Number of men firing	MNF	12-7	6-11	
Number of consecutive shots	NCS	6-1	0-5	
Word 4 Main weapon description				
Ammunition type 1 remaining	LAMW1	60-49		12-23
Ammunition type 1 originally		48-37		0-11
Ammunition type 2 remaining	LAMW2	36-25	24-35	
Ammunition type 2 originally		24-13	12-23	
Number of rounds fired at last target	LRNDS	12-1	0-11	

Word 5 Weapon B description

See Words 3 and 4 for format

Word 6 Weapon B description

See Words 3 and 4 for format

Word 7 Weapon C description

See Words 3 and 4 for format

6400 1108

Unit Characteristics JUCHAR(10,48,2) (2,10,48,2) cont'd

Word 8 Weapon C description

See Words 3 and 4 for format

Words 9 and 10 Weapon D description

See Words 3 and 4 for format

6400 1108

Visual Devices JVISA(6,2) (2,6,2)

Six words are used to store the common logarithm of the critical visual angle for 31 values of log target-background contrast (-1.50 to 0.00) in increments of .05 for each of two devices for the given light level of the treatment. Device #1 is unaided; device #2 is 7 × 50 binoculars.

Description		6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 1 Unaided eye				
Log angle for log contrast	-1.50	60-52		16-24
Log angle for log contrast	-1.45	51-43		7-15
Log angle for log contrast	-1.40	42-34	34-35	0-6
Log angle for log contrast	-1.35	33-25	25-33	
Log angle for log contrast	-1.30	24-16	16-24	
Log angle for log contrast	-1.25	15-7	7-15	
Not used		6-1	1-6	
Word 2 Unaided eye				
Log angle for log contrast	-1.20	60-52		16-24
	⋮	⋮		⋮
Log angle for log contrast	- .95	15-7	7-15	
Not used		6-1	1-6	
Word 3 Unaided eye				
Log angle for log contrast	- .90	60-52		16-24
	⋮	⋮		⋮
Log angle for log contrast	- .65	15-7	7-15	
Not used		6-1	1-6	

6400 1108
Visual Devices JVISA(6,2) (2,6,2) cont'd

Description	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 4 Unaided eye			
Log angle for log contrast - .60	60-52		16-24
Log angle for log contrast - .55	51-43		7-15
Log angle for log contrast - .50	42-34	34-35	0-6
Log angle for log contrast - .45	33-25	25-33	
Log angle for log contrast - .40	24-16	16-24	
Log angle for log contrast - .35	15-7	7-15	
Not used	6-1	1-6	
Word 5 Unaided eye			
Log angle for log contrast - .30	60-52		16-24
.	.		.
.	.		.
.	.		.
Log angle for log contrast - .05	15-7	7-15	
Not used	6-1	1-6	
Word 6 Unaided eye			
Log angle for log contrast 0.00	60-52		16-24
Not used	51-1	1-35	0-15

	6400	1108
Weapon Basic Data	JWEAP(3,56)	(2,3,56)

Forms Weapon 1, Weapon 3.

For purposes of data storage the weapons are divided into three groups. These groups are: (1) artillery and mortars, (2) direct fire weapons with fragmentation ammo, and (3) direct fire weapons with no fragmentation ammo. Each weapon requires three words to describe its basic characteristics.

Description		Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 1 Basic data					
Neutralization weight per round		MW	60-55		19-24
Minimum range		MINWRG	54-43		7-18
Maximum range		MAXWRG	42-28	28-35	0-6
Crew size		KREW	27-22	22-27	
Flight time per grid	.XXX	LFLT	21-10	10-21	
Rounds/trigger pull		LRND1	9-4	4-9	
Not used			3-1	1-3	
Word 2 Basic data					
Aim time	X.XXX	LAIM	60-49		13-24
SD aim time	.XX	LAIM1	48-43		7-12
Reaim time	X.XXX	LRAIM	42-31	31-35	0-6
SD reaim time	.XX	LRAIM1	30-25	25-30	
Reload time	X.XXX	LOAD	24-13	13-24	
SD reload time	.XX	LOAD1	12-7	7-12	
Not used			6-1	1-6	
Word 3 Basic data					
Reload only after impact		KL1	60		24
Range tie breaker		LRTIE	59		23
Ammo type #1 is fragmentation	(Group 2 only)	MKIL1	58		22

6400 1108
Weapon Basic Data JWEAP(3,56) (2,3,56) cont'd

Description	Local variable	6400 bit no.	1108 bit no. Word 1	1108 bit no. Word 2
Word 3 Basic data cont'd				
Ammo type #2 is fragmentation (Group 2 only)	MKIL2	57		21
Vulnerability Class #1 use Ammo 2	LKAM	56		20
⋮	⋮	⋮		⋮
Vulnerability Class #12 use Ammo 2	LKAM	45		9
Category 2-3 weapons				
Weapons firing signature	LKWS	44-39		3-8
Category 1 weapons				
Direction of artillery impact area	IMPDIR	36-34	34-35	0
Width of artillery impact area	IMPN1	33-31	31-33	
Length of artillery impact area	IMPN2	30-28	28-30	
Not used		27-1	1-27	

Computational Values (Real)

Integral of relative luminosity and night sky brightness P1(3). Three words are used to store the computed integral approximation of night sky brightness and relative luminosity P1 for the three light levels of: 1=starlight; 2=moonlight; and 3=part moon. Each value for each light level is stored as a real number.

Image intensifier value P2, P2(6). Six words are used to store the value computed integral approximation P2 for the 6 image intensifier devices. Each value for each device is stored as a real number.

Night Sky Brightness SBK(11)

Eleven words are used to store the data of night sky brightness for the specific light level as defined in the treatment as 1=starlight, 2=moonlight, and 3=partial moonlight. The measure of light level is in foot-lamberts.

Word 1

Light level for wavelength (microns) = .40

Word 2

Light level for wavelength (microns) = .45

Word 3

Light level for wavelength (microns) = .50

Word 4

Light level for wavelength (microns) = .55

Word 5

Light level for wavelength (microns) = .60

Word 6

Light level for wavelength (microns) = .65

Word 7

Light level for wavelength (microns) = .70

Word 8

Light level for wavelength (microns) = .75

Word 9

Light level for wavelength (microns) = .80

Word 10

Light level for wavelength (microns) = .85

Word 11

Light level for wavelength (microns) = .90

Target reflectance for I.I. devices TREFM2(6,16). Sixteen words are used to store the target reflectance for I.I. devices for 16 target classes for each of 6 image intensifier devices. Each value for each device and each target classs is stored as a real number.

Target reflectance for visual devices TREFM4(16). Sixteen words are used to store the computed approximation of target reflectance for visual devices for 16 target classes. Each value for each target class is stored as a real number.